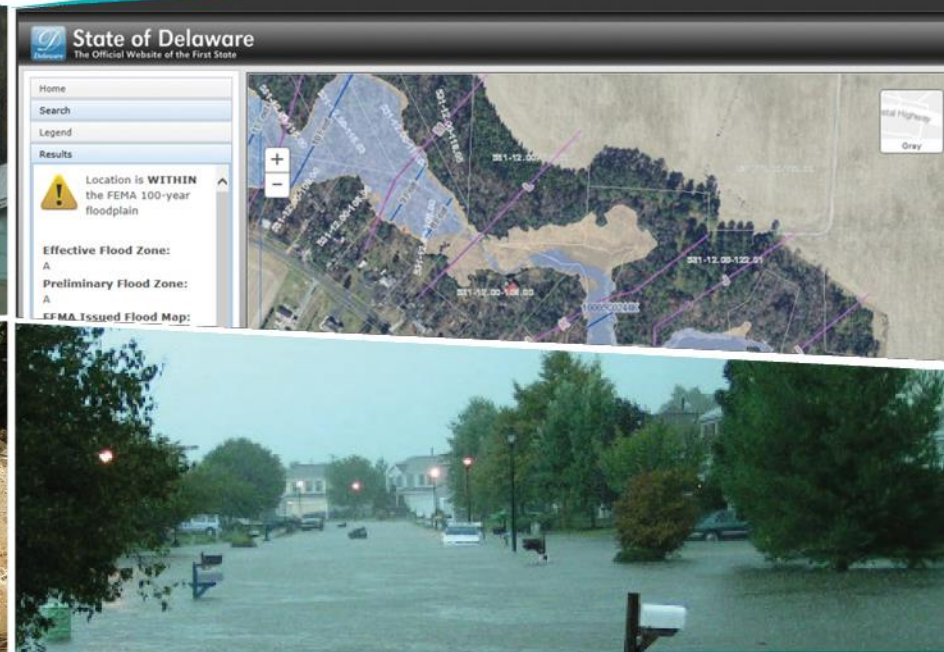


DNREC Floodplain Training

March 13, 2018





Introductions

Tucker Clevenger, PE, CFM – Amec Foster Wheeler (Wood)

- **Over 18 Years NFIP Floodplain Modeling, Mapping and Management Experience**
- **FEMA Region III Flood Risk Contractor – 16 years**
- **Supporting DNREC Flood Risk Mapping initiative for nearly a decade**
- **LOMC Review and Processing Experience**

Greg Williams, CFM

- **State NFIP Coordinator**
- **Over 11 years as an Environmental Scientist with DNREC**
- **Certified Floodplain Manager**

Mike Townshend

- **Sr. Software Engineer, Department of Technology and Information**
- **Lead Developer for DNREC Flood Mapping Tool**

Safety Moment

**It takes only 1 foot of water to float many cars!
2 feet of rushing water will lift and carry away most cars including
SUVs and pickups!**

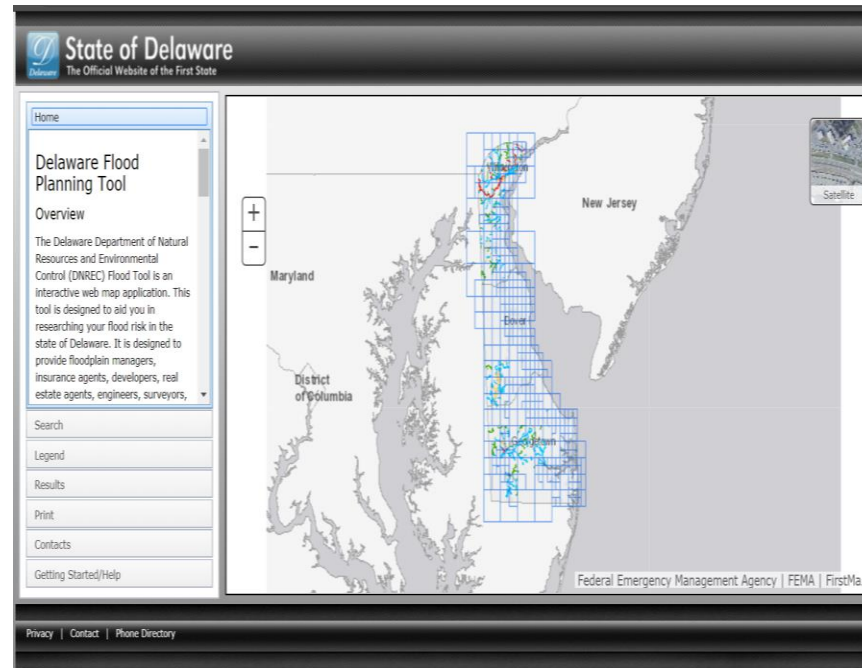




Reason for training

DNREC developed Flood Planning Tool

- ▶ With help from DTI.
- ▶ As response to FEMA portal going away.





Keep in Mind

FEMA offers the National Flood Insurance Program (NFIP)

DNREC is a Cooperating Technical Partner (CTP)

- ▶ Work to update maps.
- ▶ Provide outreach and assistance.

Communities participate in the NFIP

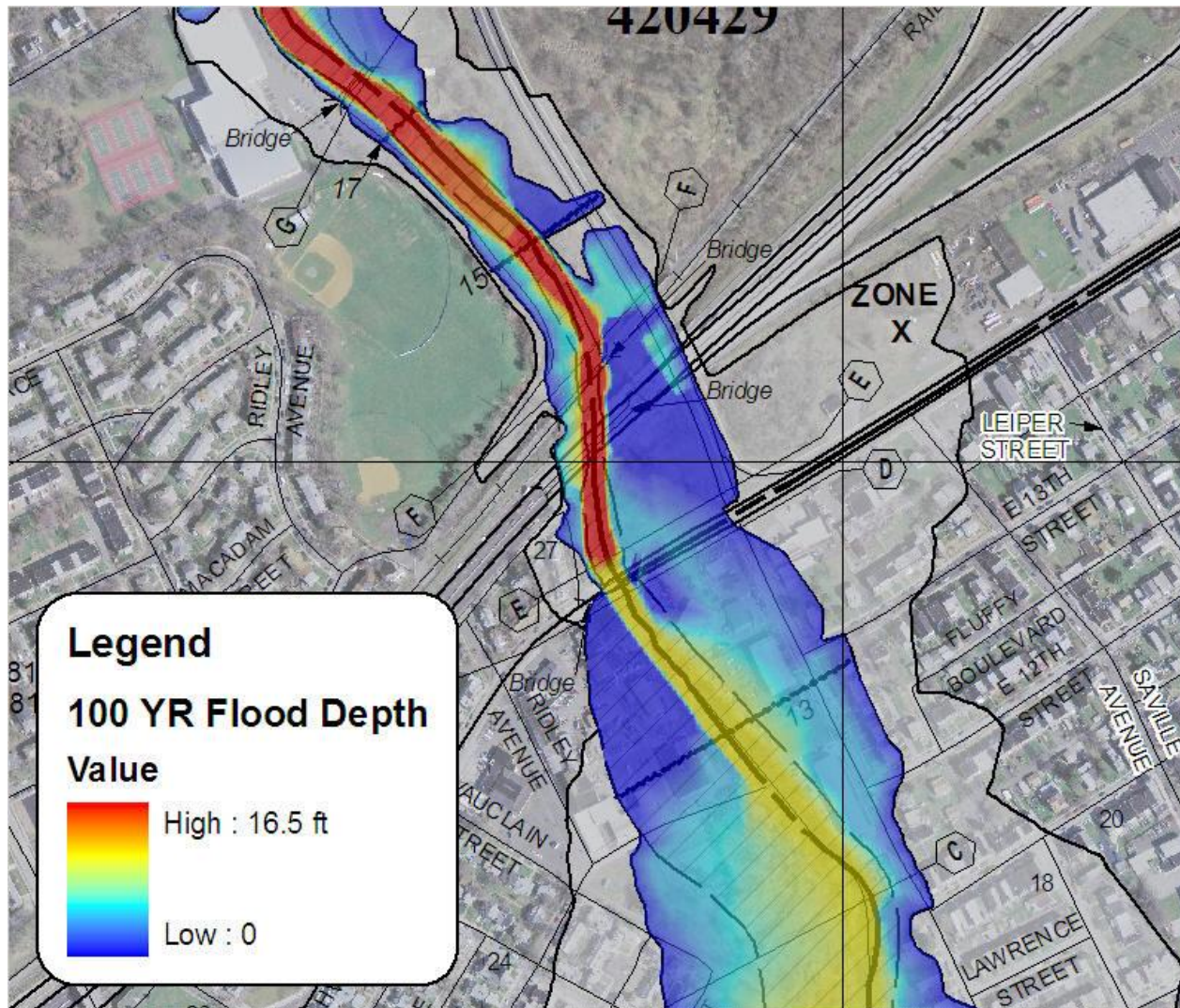
- ▶ Adopt and enforce floodplain regulations.
- ▶ Permit all development in the floodplain.
- ▶ Use current effective map and best available data.



Agenda

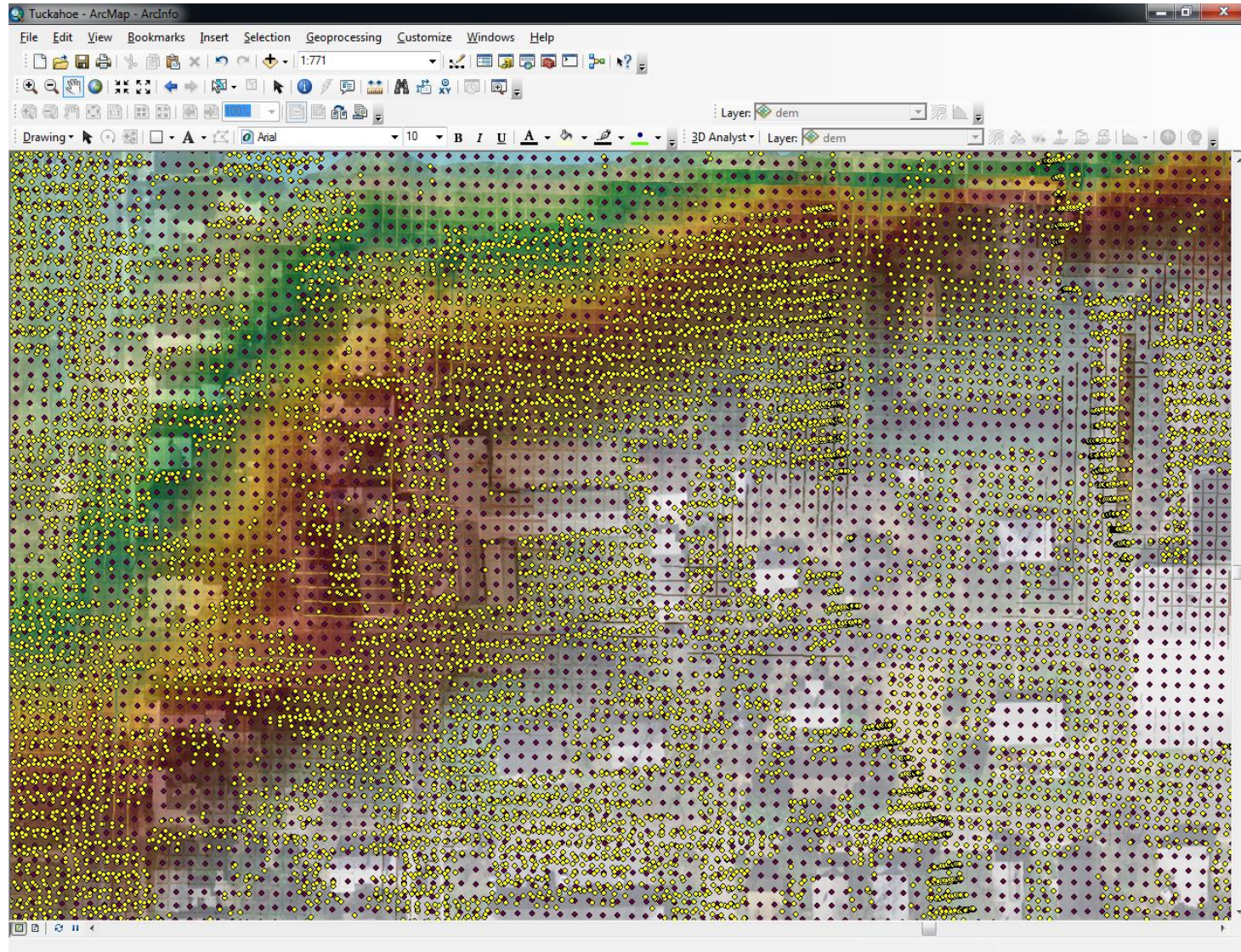
TIME	TOPIC
9:00 AM	Introductions/Safety Moment
9:10 AM	Training/Website Background and Overview
9:20 AM	DNREC Website Introduction <ul style="list-style-type: none"> • General Use and Functionality • Available datasets • Preliminary versus effective information • Download capabilities
9:40 AM	FEMA/DNREC Study type Review <ul style="list-style-type: none"> • Riverine Zones (Detailed, Limited Detailed, Approximate) • Coastal Zones (AE, VE)
9:50 AM	Break
10:00 AM	FEMA NFIP Minimum Floodplain Development Requirements <ul style="list-style-type: none"> • Riverine and Coastal Zones • DNREC State Requirements • When is a FEMA LOMR/CLOMR Required? • Managing development in FEMA Zone A Floodplains • LOMAs/LOMR-Fs/Elevation Certificates
10:25 PM	Site Specific Floodplain Management Examples/Case Studies <ul style="list-style-type: none"> • Detailed floodplain (Zone AE) with floodway • Approximate floodplain (Zone A) with AFH information • Coastal (Zone VE, AE) • Preliminary and Effective data examples
10:50 AM	Questions/Comments/Wrap-up
11:00 AM	Adjourn

Flood Risk Mapping Evolution



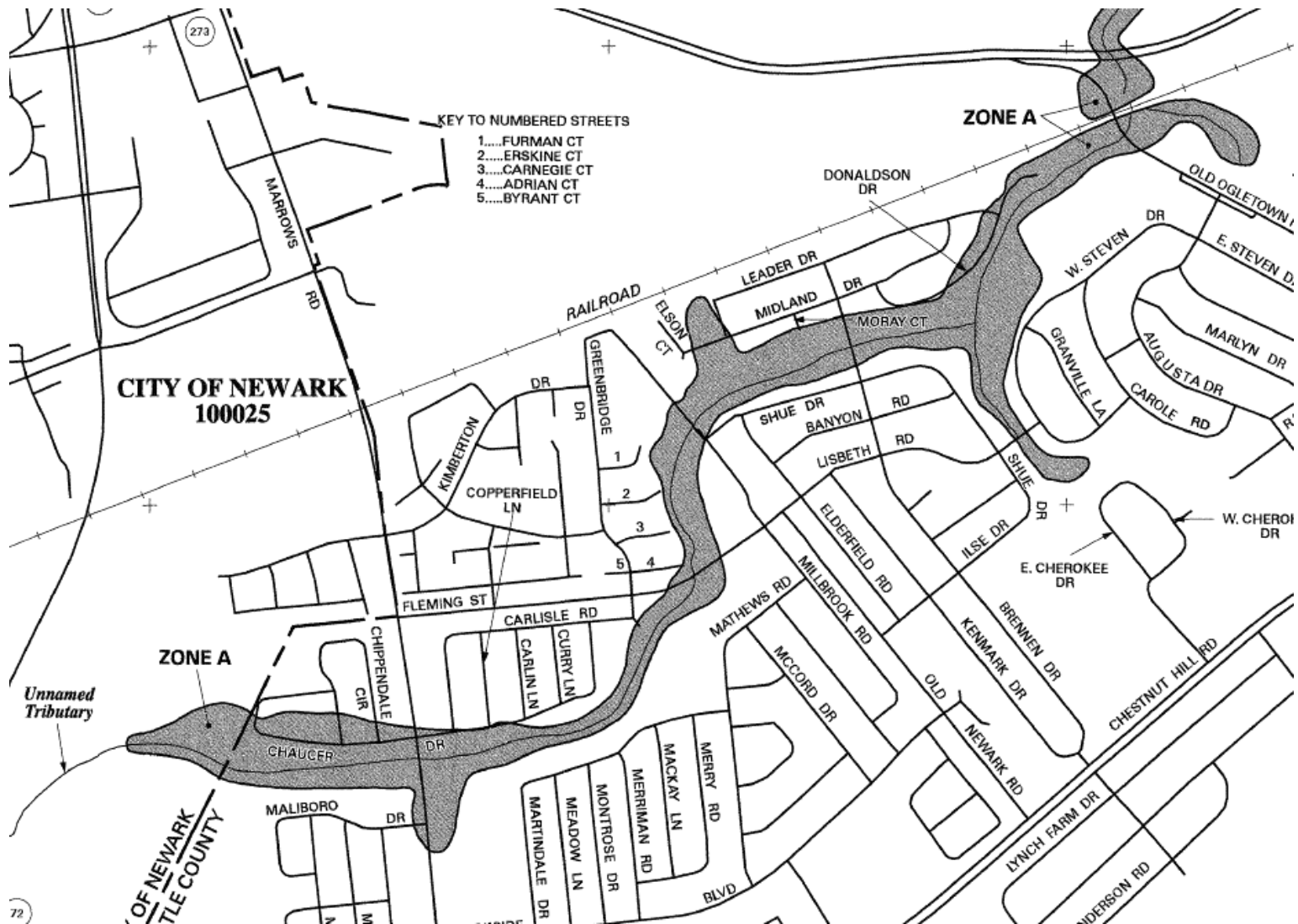


LiDAR Topographic Data



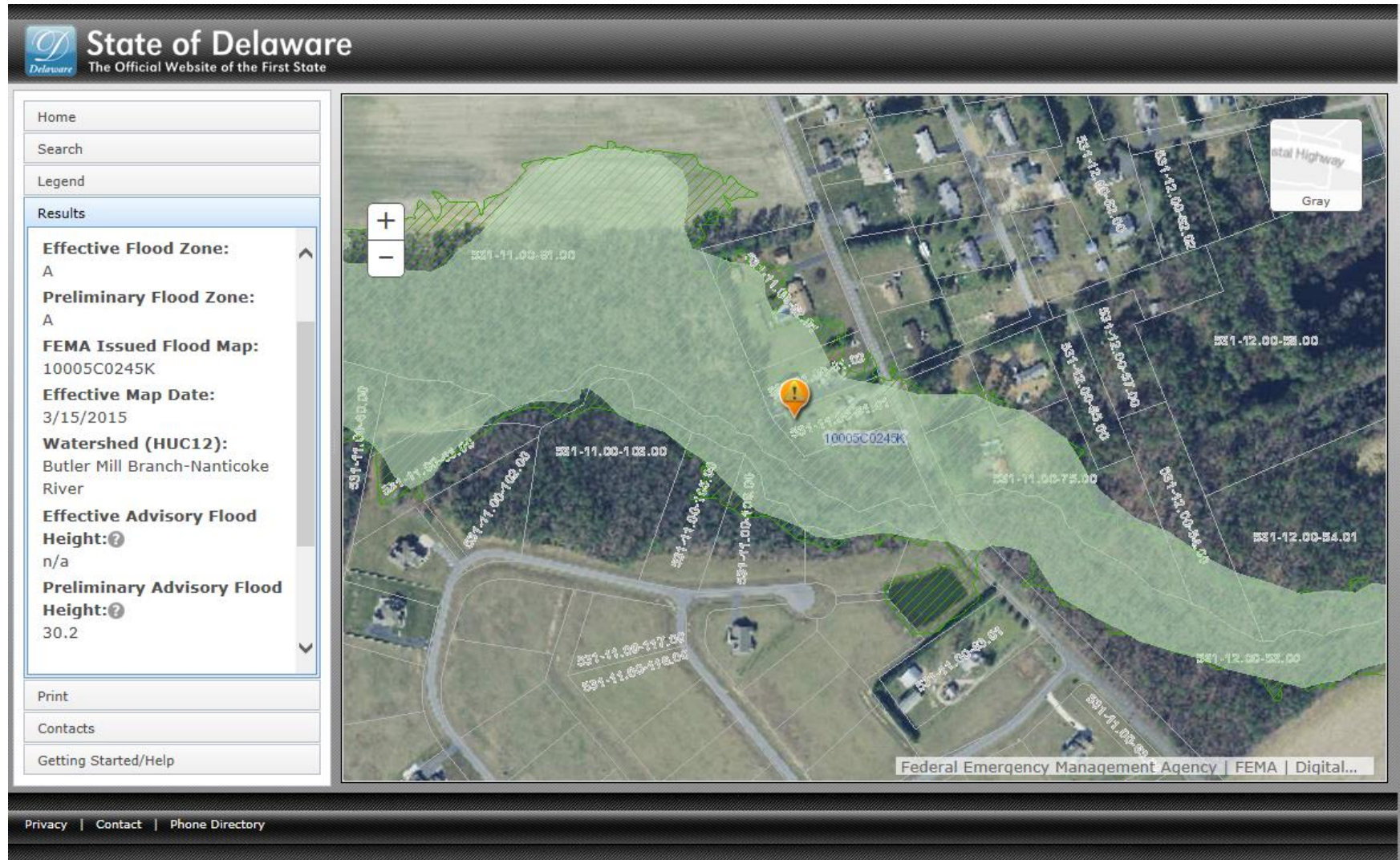


Flood Risk Mapping Evolution





Flood Risk Mapping Evolution



Flood Risk Mapping Evolution





Delaware Flood Planning Tool

<http://maps.dnrec.delaware.gov/FloodPlanning/default.html>

A screenshot of the Delaware Flood Planning Tool web application. The page has a dark grey header with the "State of Delaware" logo and text "The Official Website of the First State". On the left, there is a light blue sidebar with a "Home" link, a "Delaware Flood Planning Tool" title, an "Overview" section with descriptive text, and a list of links: "Search", "Legend", "Results", "Print", "Contacts", and "Getting Started/Help". The main area is a map of Delaware with a blue grid overlay. The map shows various colored regions (red, orange, green, blue) representing different flood risk levels. Labels for "Washington", "Dover", and "Georgetown" are visible on the map. A small inset map in the top right corner shows a satellite view of a specific area. At the bottom of the map area, there is a footer that reads "Federal Emergency Management Agency | FEMA | FirstMa...". The bottom of the page has a dark grey footer with links for "Privacy", "Contact", and "Phone Directory".



Preliminary vs. Effective DFIRM Data

- **Preliminary DFIRM data is essentially a final draft version of the DFIRM that is subject to appeal and revision**
- **Effective DFIRM data is final and is used as a baseline to enforce the FEMA NFIP regulations and to determine actuarial insurance ratings**
- **It typically takes 12-18 months for a preliminary DFIRM to become Final/Effective**
- **The Letter of Final Determination (LFD) is issued 6-months prior to effective date and nothing will change on the maps after this point**
- **FEMA is in a consistent cycle of updating their flood maps**
- **This cycle presents challenges from a floodplain management perspective on the use of flood risk datasets**

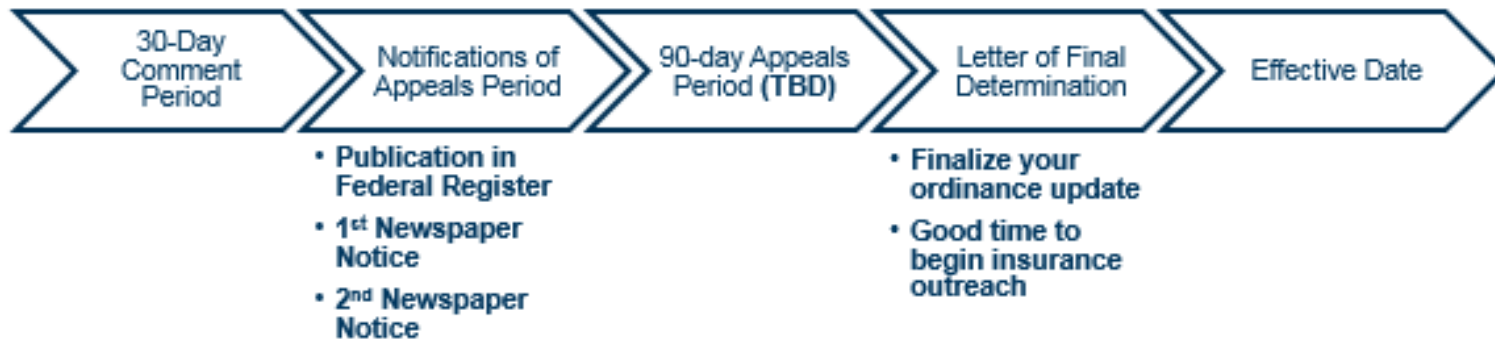


Map Update and Adoption Process

Process to date:



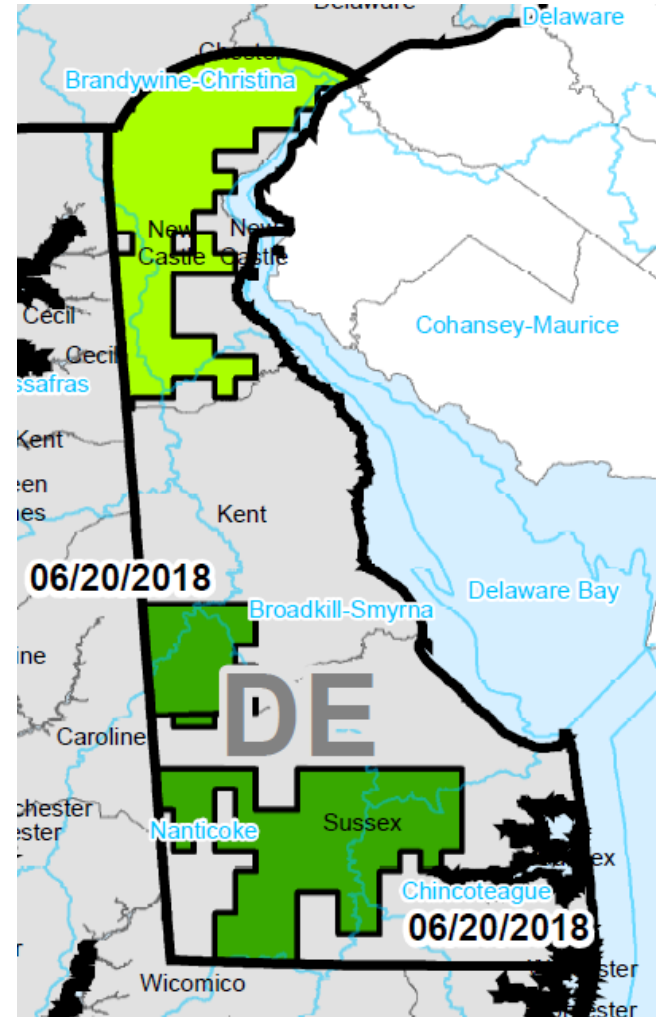
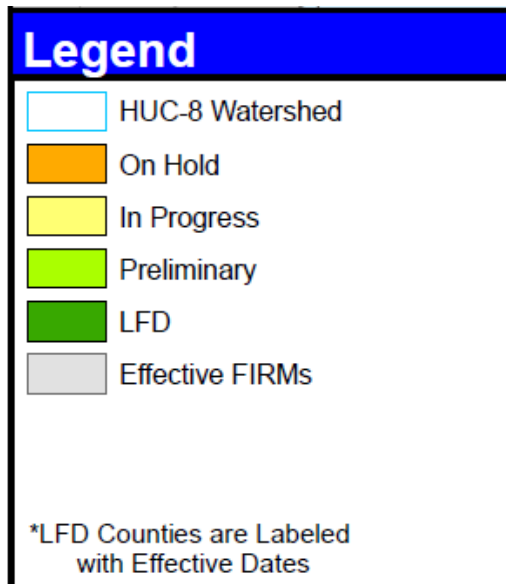
Next Steps:



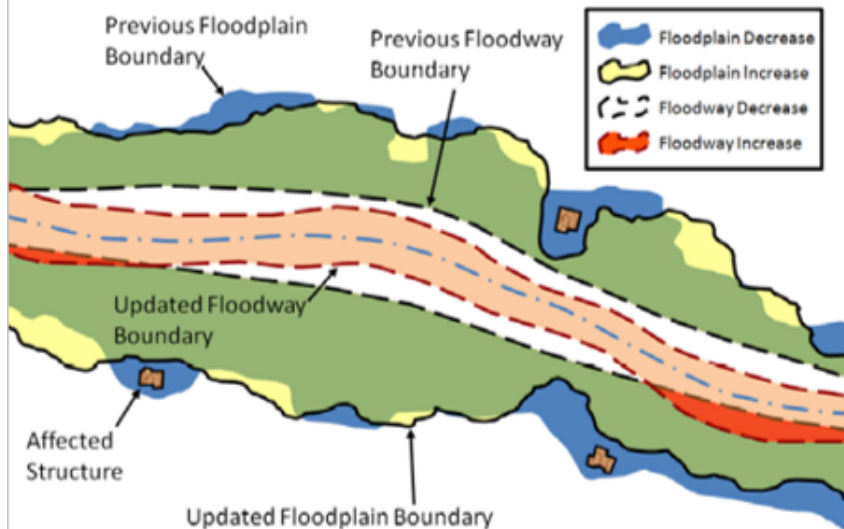
Preliminary vs. Effective DFIRM Data

Delaware DFIRM Status

- Kent and Sussex have LFDs issued – effective on 6/20/18
- New Castle is Preliminary – LFD date is to be determined (late 2018 at earliest)



Preliminary vs. Effective Data Use

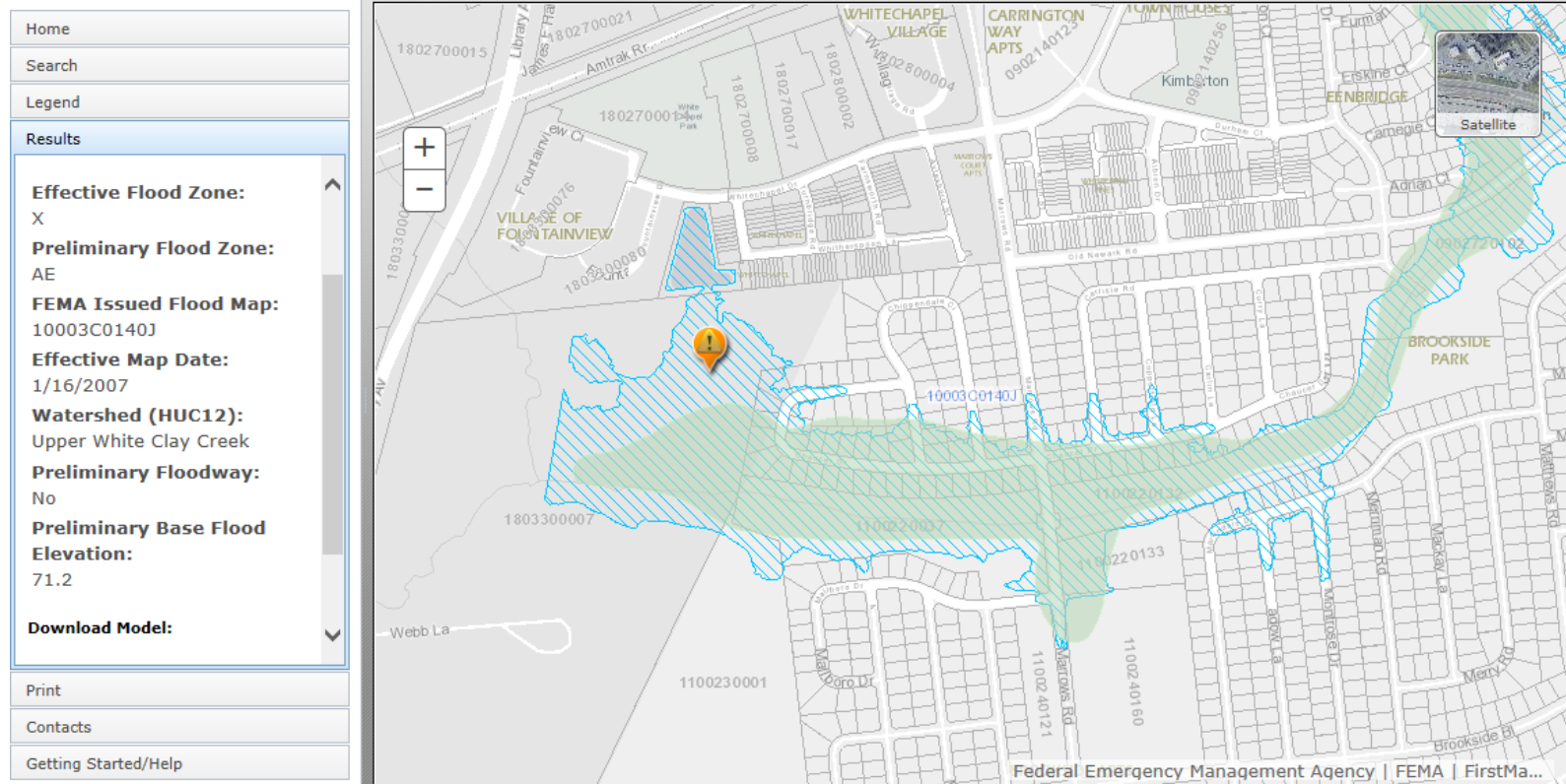


- ▶ Recommend using “best available data” to **build / rebuild** safely
 - Permit with two sets of data and regulate to the **most restrictive**
 - Inform applicants of the future risk and **insurance implications**
 - Potential community liability
- ▶ Recommendation vs. requirement
 - Unless formally adopted by the community, use of best available data is not required
 - Communities must regulate at least to **current effective data**



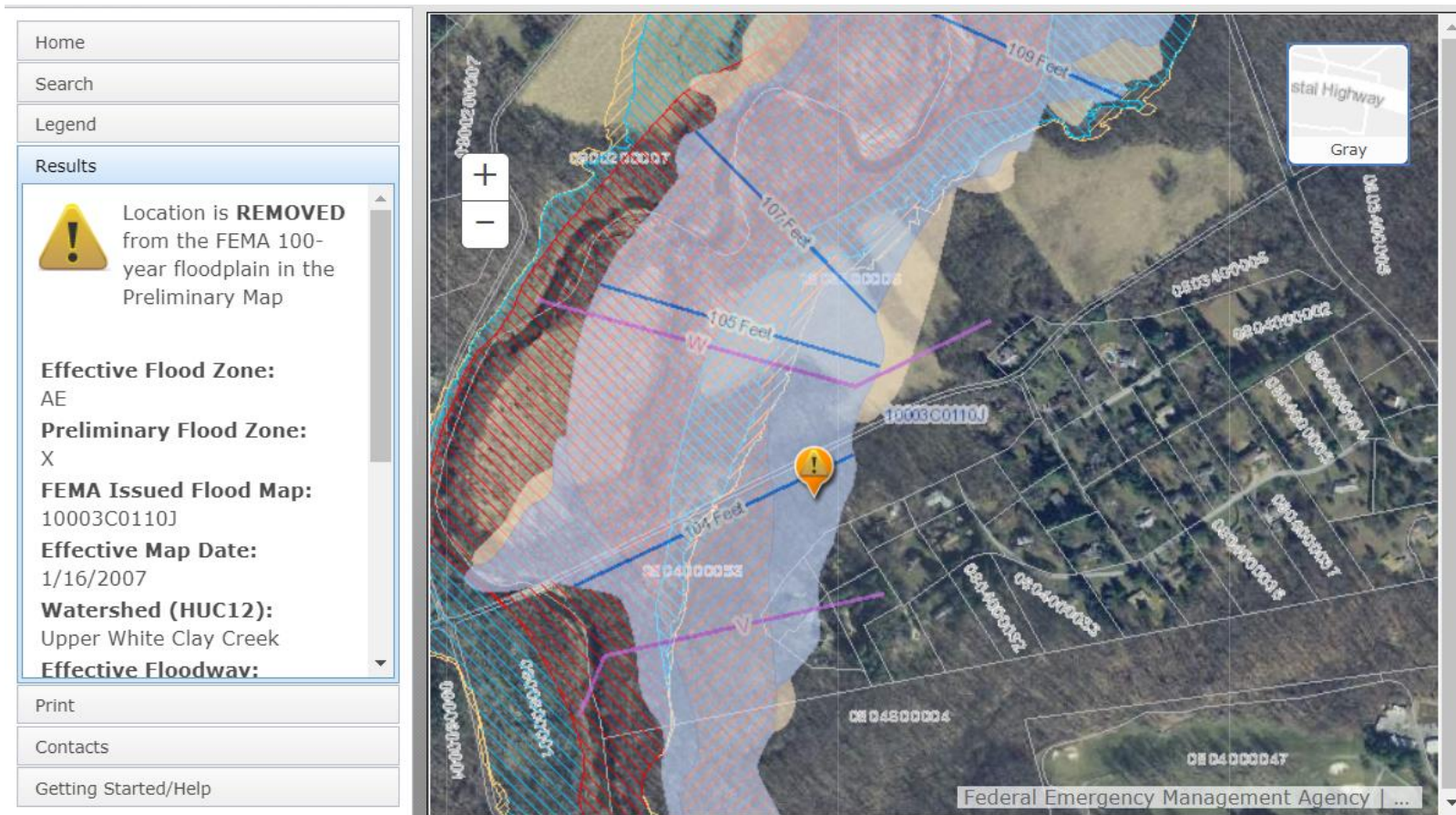
Guidelines on Preliminary Data Use

- **IF Preliminary DFIRM mapping shows a more conservative/expansive flood risk, use this information as best available to manage floodplain development — 16 Chippendale Circle, Newark, DE**



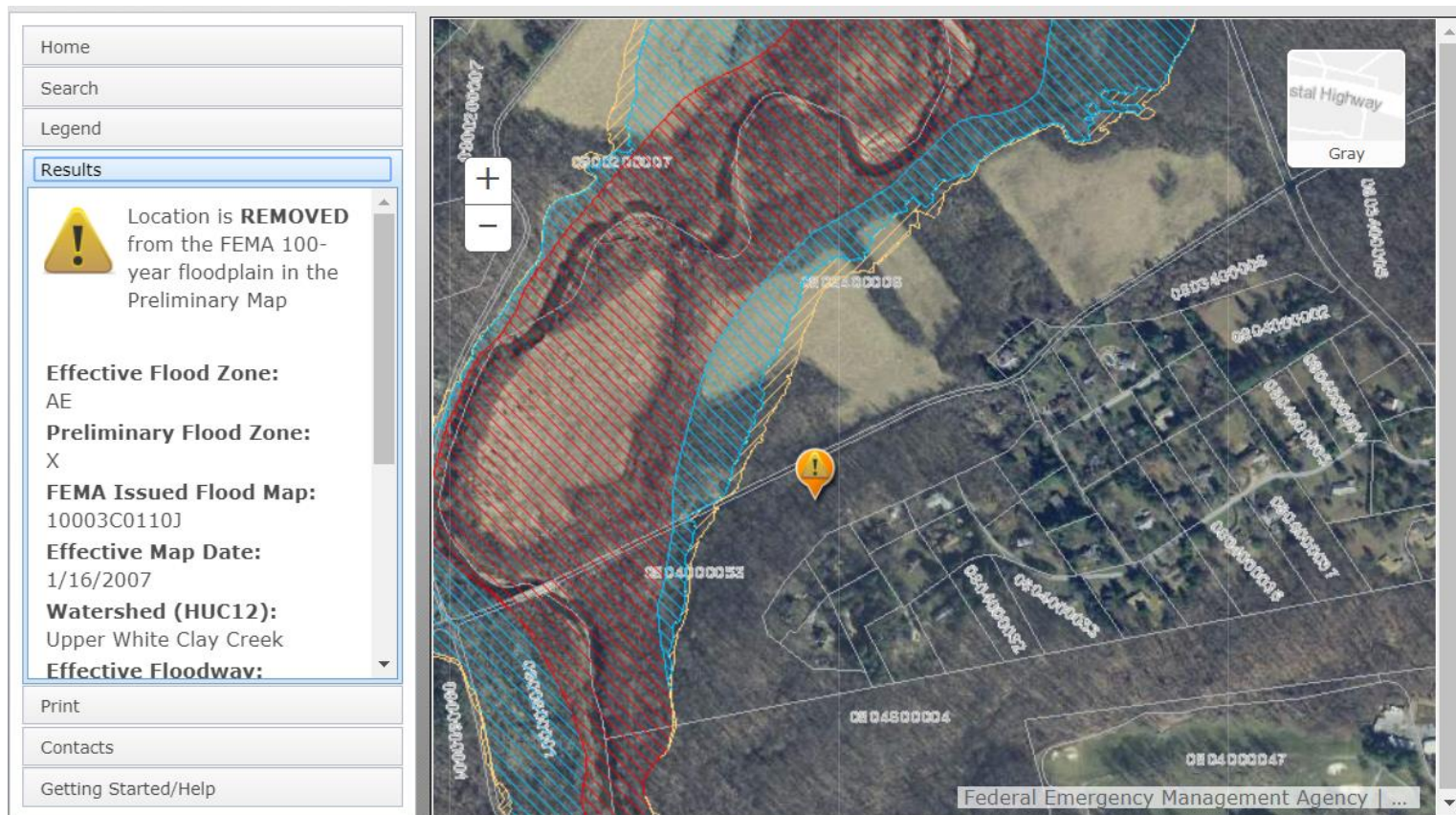
Guidelines on Preliminary Data Use

IF Preliminary DFIRM mapping shows REDUCED flood risk.....

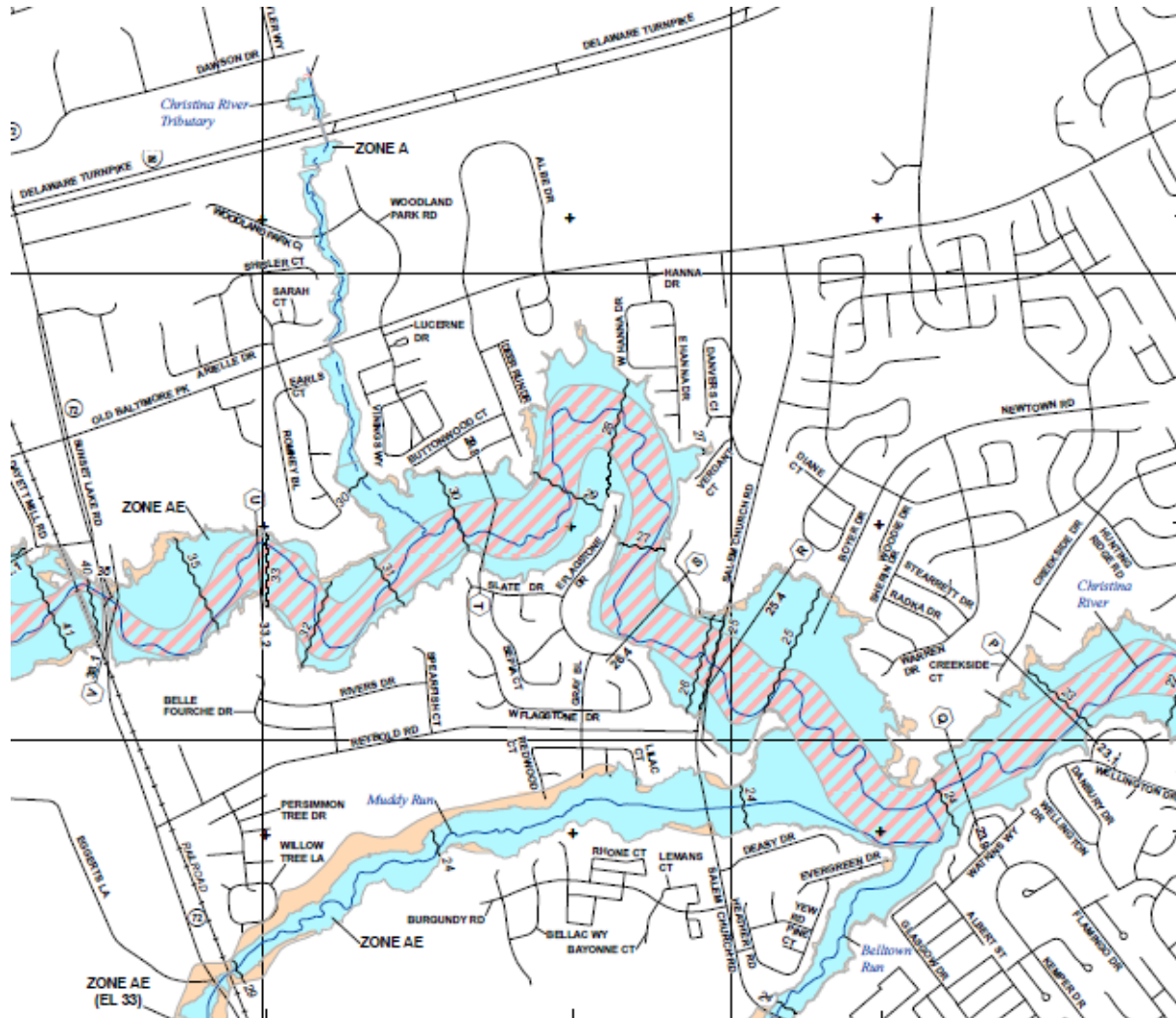


Guidelines on Preliminary Data Use

Development should NOT be permitted based on the preliminary floodplains prior to LFD — 216 Unami Trail, Newark, DE



FEMA Study Types





FEMA Study Type Details

		Approximate	Limited Detail	Detailed
Survey	Channel XS	None	Rarely	Pre-determined intervals
	Hydraulic Structures	None	Field Measured (no vertical control)	Field Surveyed (with vertical control)
Hydrology	Methodology	Regression Equation/ Gage Analysis	Regression Equation/ Gage Analysis	Regression Equation/ Gage Analysis
Hydraulics	Recurrence Interval	10%, 4%, 2%, 1%, 1% Plus, and 2% annual chance	10%, 4%, 2%, 1%, 1% Plus, and 2% annual chance	10%, 4%, 2%, 1%, 1% Plus, and 2% annual chance
	Manning's "n"	Aerial Imagery (Composite Values)	Aerial Imagery (Horizontal Variation)	Aerial Imagery (Horizontal Variation)
	Channel Geometry	LiDAR	LiDAR with Field Recon	LiDAR with Field Survey
Mapping	Boundaries	1% annual chance	1% annual chance, BFEs, XSs	1- and 0.2-% annual chance, BFEs, XSs
	Flood Zones	Zone A (no BFEs)	Zone AE (w/ BFEs)	Zone AE (w/ BFEs) and Floodway
FIS Report	Tables	None	Summary of Discharge, Roughness Coefficient	Summary of Discharge, Floodway Data, Roughness Coefficient
	Profiles	None	1% annual chance	10-, 4-, 2-, 1-, 0.2-% annual chance (others as needed)

DNREC Structure Inventory

- **Stream Crossing Survey**
 - ▶ Relative dimensions
 - ▶ Structure material
 - ▶ Piers
 - ▶ Entrance parameters
 - ▶ Photographs
 - ▶ Control channel





Hydrology

Scientific Investigations Report 2006-5146, *Magnitude and Frequency of Floods of Nontidal Streams in Delaware.*

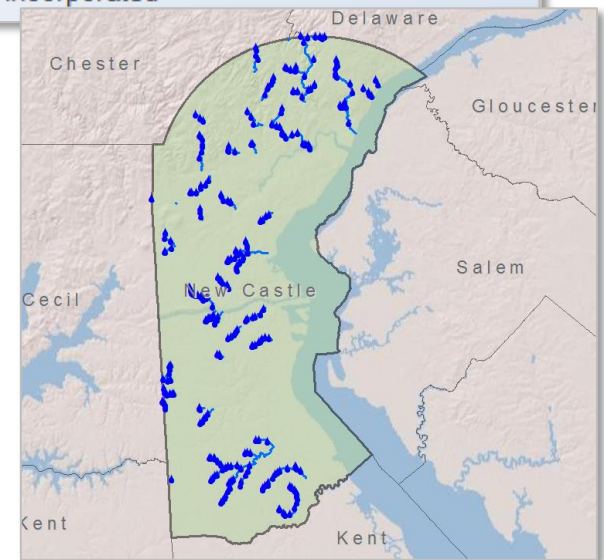
- ▶ *DRANAREA* – drainage area in mi²
- ▶ *BSLDEM10M* – mean basin slope determined from a 10-m DEM, in percent
- ▶ *Soil A* – hydrologic soil type A, in percent, high infiltration-rate soils
- ▶ *Forest* – percent forest cover
- ▶ *STORNHD* – percent storage, from NHD' =

Applicability/Limitations

- ▶ Urbanization
- ▶ Flood Control Facilities

Hydrologic Analysis

- ✓ Cost effective, proven, FEMA endorsed methodology for developing Regression based discharges
- ✓ Consistent with DelDOT hydrologic approach
- ✓ Methodology consistent with Delaware StreamStats
- ✓ Automated, GIS-based approach to improve efficiency/accuracy
- ✓ Bulletin 17B analysis for gaged streams incorporated





Riverine Approximate Study

ADVANTAGES

- ▶ Cost-effective
- ▶ Applicable for more undeveloped areas
- ▶ Boundaries are mapped
- ▶ Now supported by digital models that can be updated

DISADVANTAGES

- ▶ No calibration to high water marks
- ▶ Structures are not modeled
- ▶ May not be applicable in areas of storage (ponds, lakes, etc.)
- ▶ Dependent upon the quality of topographic data
- ▶ Previously not supported by digital models



What is model backed Zone A?

Zone A's are now routinely supported by automated hydrologic and hydraulic modeling

- Utilizes best available topographic data
- Incorporates HEC-RAS
- Digital, georeferenced product
- Improved floodplain detail and accuracy
- Starting point for detailed studies
- Water Surface Elevations (WSELs) are not published on FIRMs/FIS, but Floodplain Administrators can use WSELs from model as best available data for permitting in Zone A





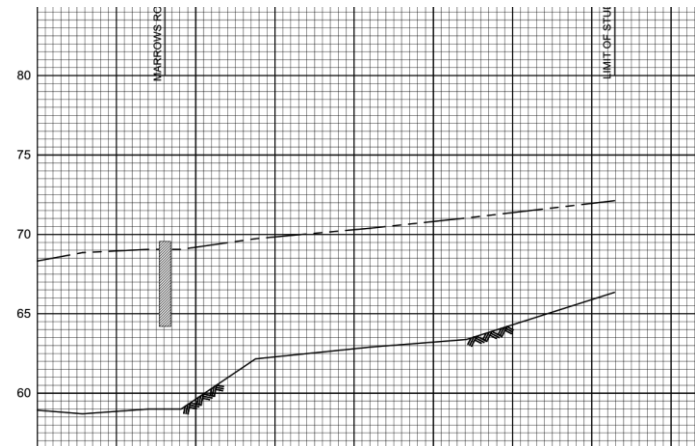
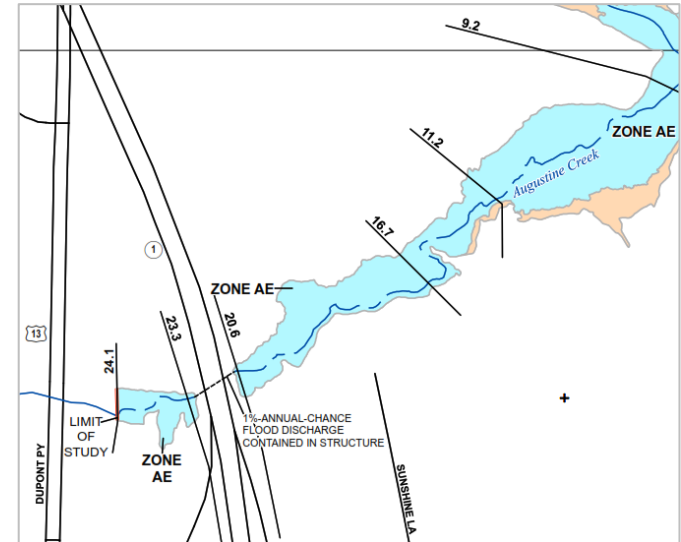
Riverine Limited Detail Study

ADVANTAGES

- ▶ Engineering and modeling are considerably more advanced
- ▶ Less expensive than a detailed study
- ▶ Structures are included
- ▶ More detailed survey data can be added to models later
- ▶ Base Flood elevations are established

DISADVANTAGES

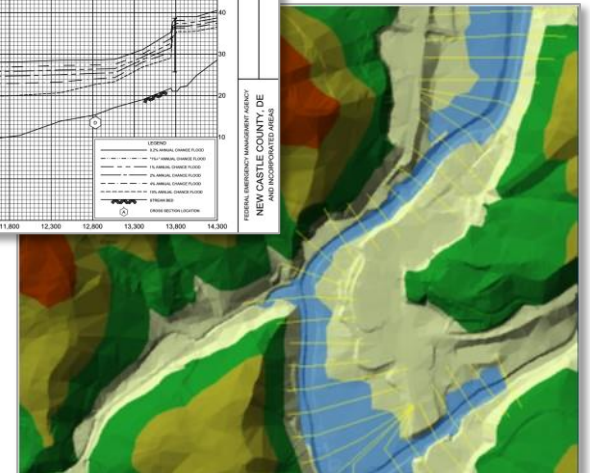
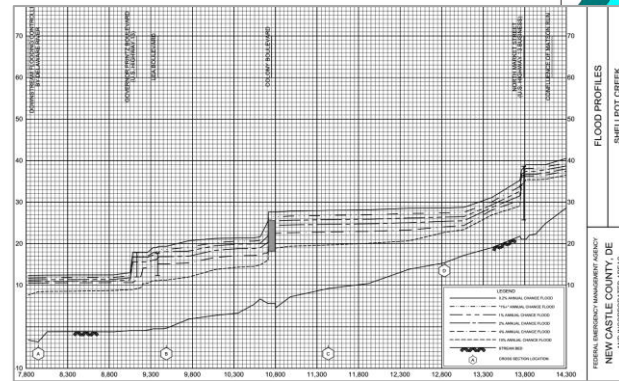
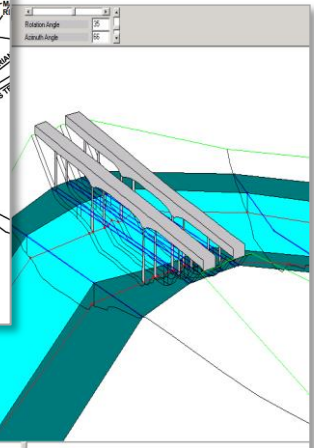
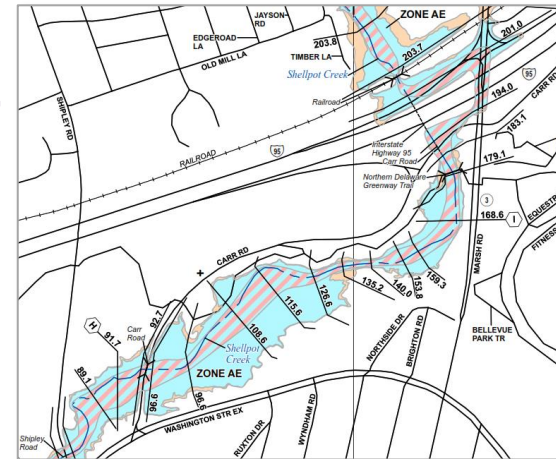
- ▶ Structures are field measured but not surveyed
- ▶ Natural channel bank cross sections are not surveyed
- ▶ Fine modeling details are not considered
- ▶ No floodways



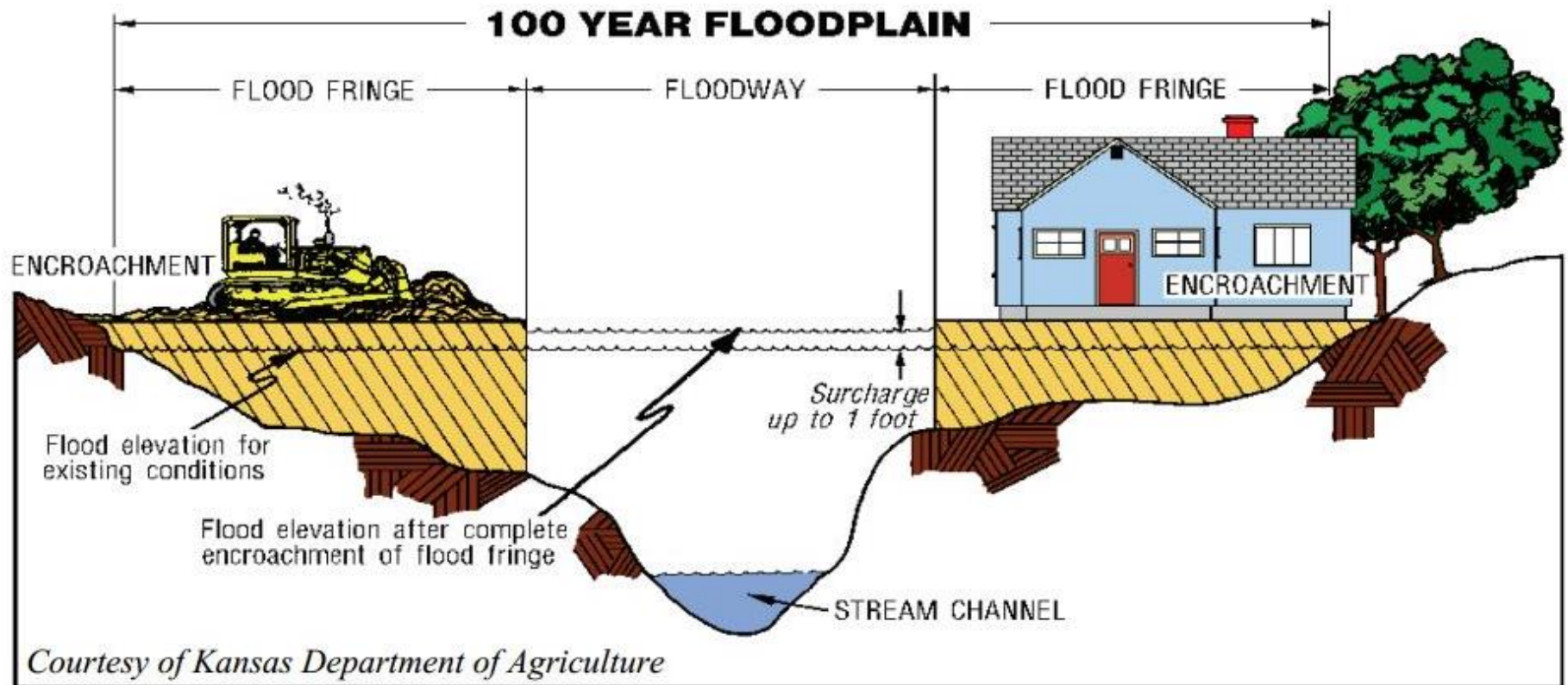
Riverine Detailed Study

The same detailed methodology that many of you already know and love...

- ▶ Developed using HEC-RAS 4.1
- ▶ Channels incorporated based on field survey
- ▶ Encroachments computed and floodways mapped
- ▶ Detailed hydraulic parameter refinement (coefficients, obstructions, Mannings 'n' values, etc)
- ▶ Multiple flood profiles included in FIS



FEMA Floodways

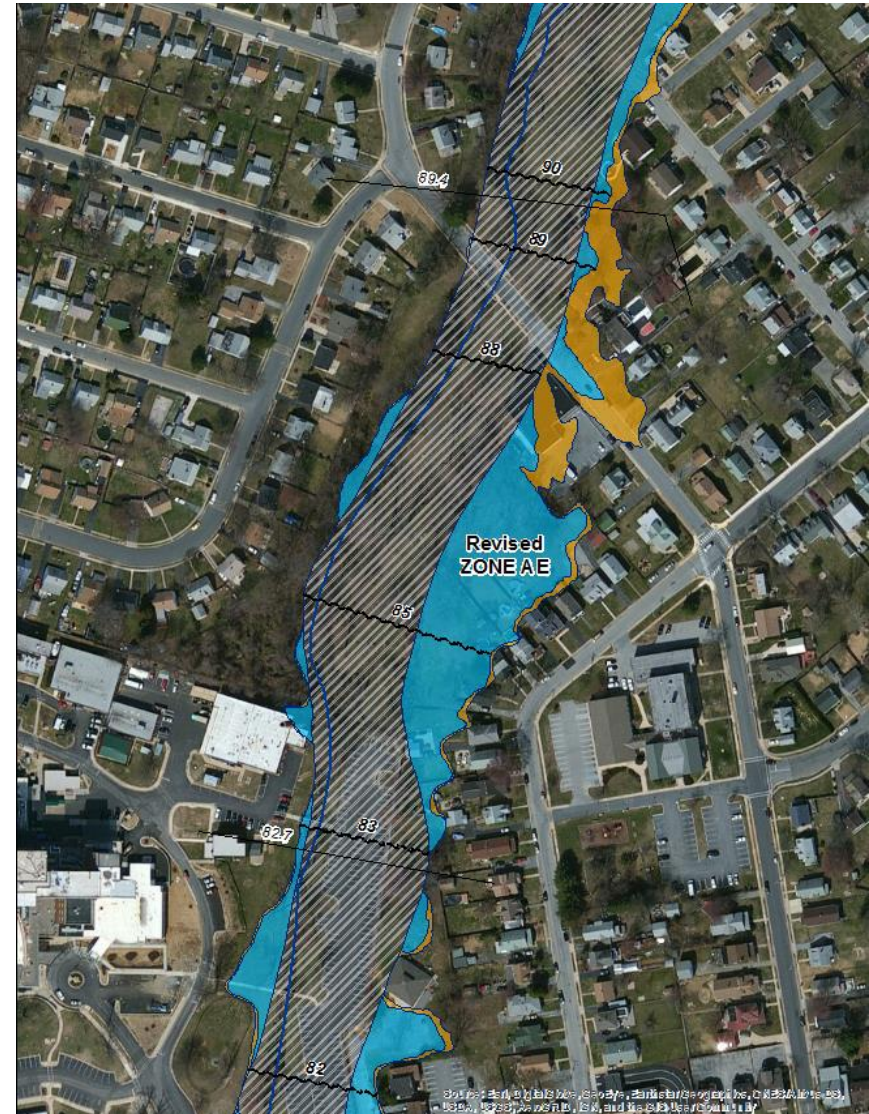


Courtesy of Kansas Department of Agriculture

Redelineation

Redelineation is...

- ▶ Method of redrawing floodplain boundaries to match updated topographic data using the previously established WSELs from the Effective FIRM/FIS
- ▶ No revised engineering analyses, flood profile, or other change...
just revised floodplain boundaries



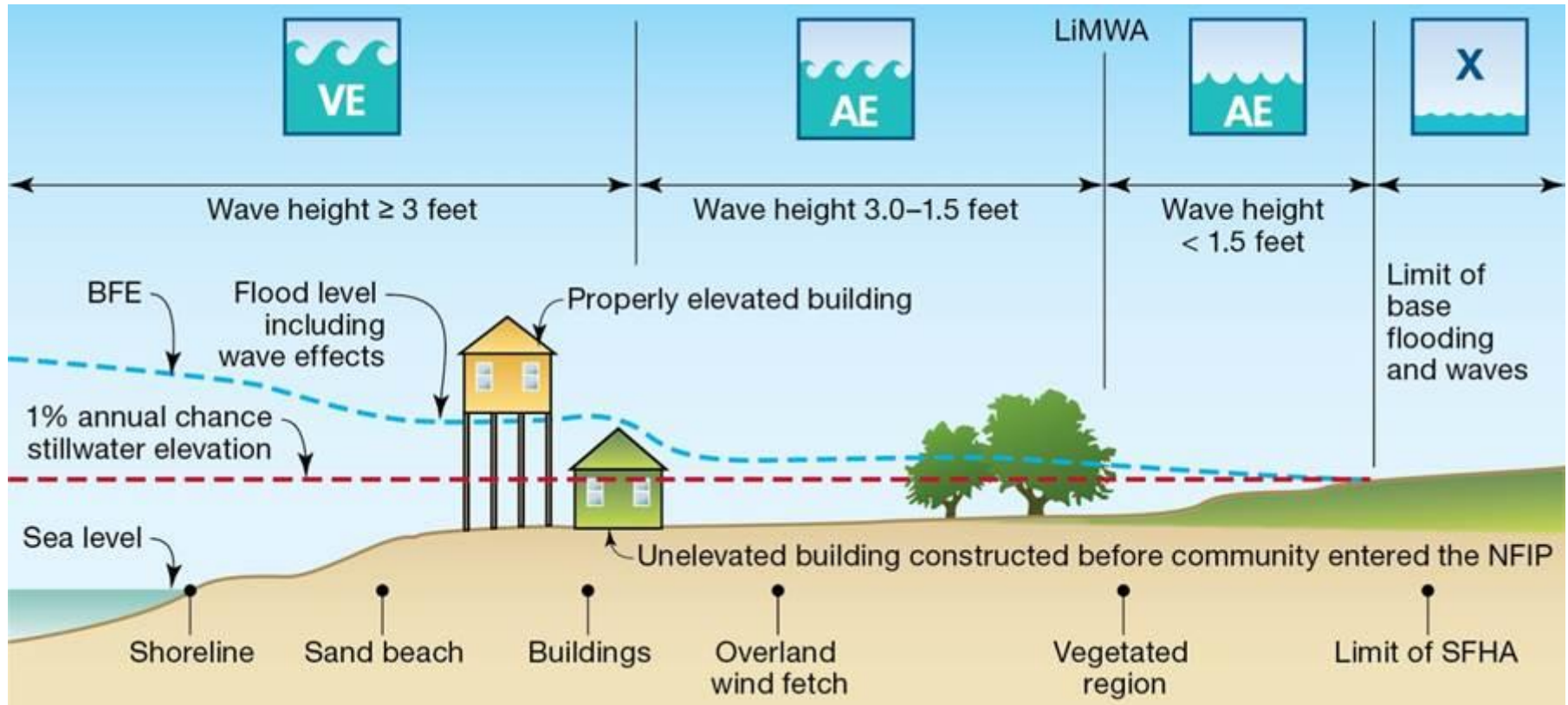


Coastal Floodplains (VE/AE)





Coastal Floodplains (VE/AE)



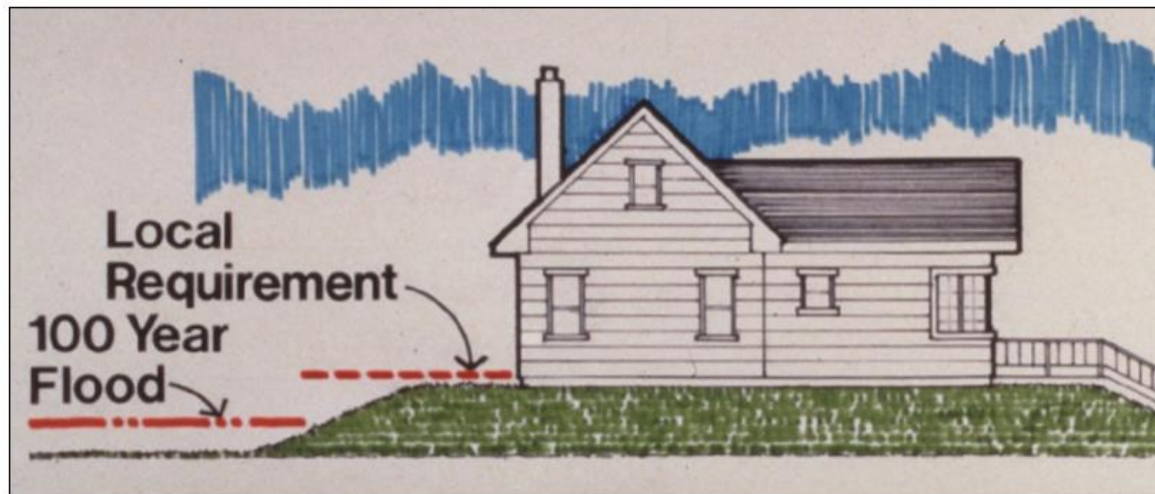
Higher Regulatory Standards

430 – Higher Regulatory Standards

Manual Page 430-2

Objective: have regulations that

- ✓ Protect existing and future development
- ✓ Protect natural floodplain functions
- ✓ Exceed the NFIP's minimum criteria



Managing Floodplain Development

Elevation

- Structure is raised so lowest floor is at or above the Design Flood Elevation (DFE)
- Protects structure from damage in a base flood



FEMA P-55, Figure 2-14

Base flood elevation

(BFE): Flood having a 1-percent chance of being exceeded in any given year.

Design flood elevation

(DFE): Regulatory flood elevation adopted by a local community. Typically, the DFE is the BFE plus any freeboard adopted by the community.

Managing Floodplain Development



Managing Floodplain Development

Fill

- + Cheap way to elevate
- + Keeps water away from the building
- + Can get a LOMR-F
- + Easier for landscaping
- Reduces storage capacity (riverine floodplains)
- Kill native vegetation
- Redirects drainage onto others
- Adversely affects water quality

09/23/2004



What is a LOMC?

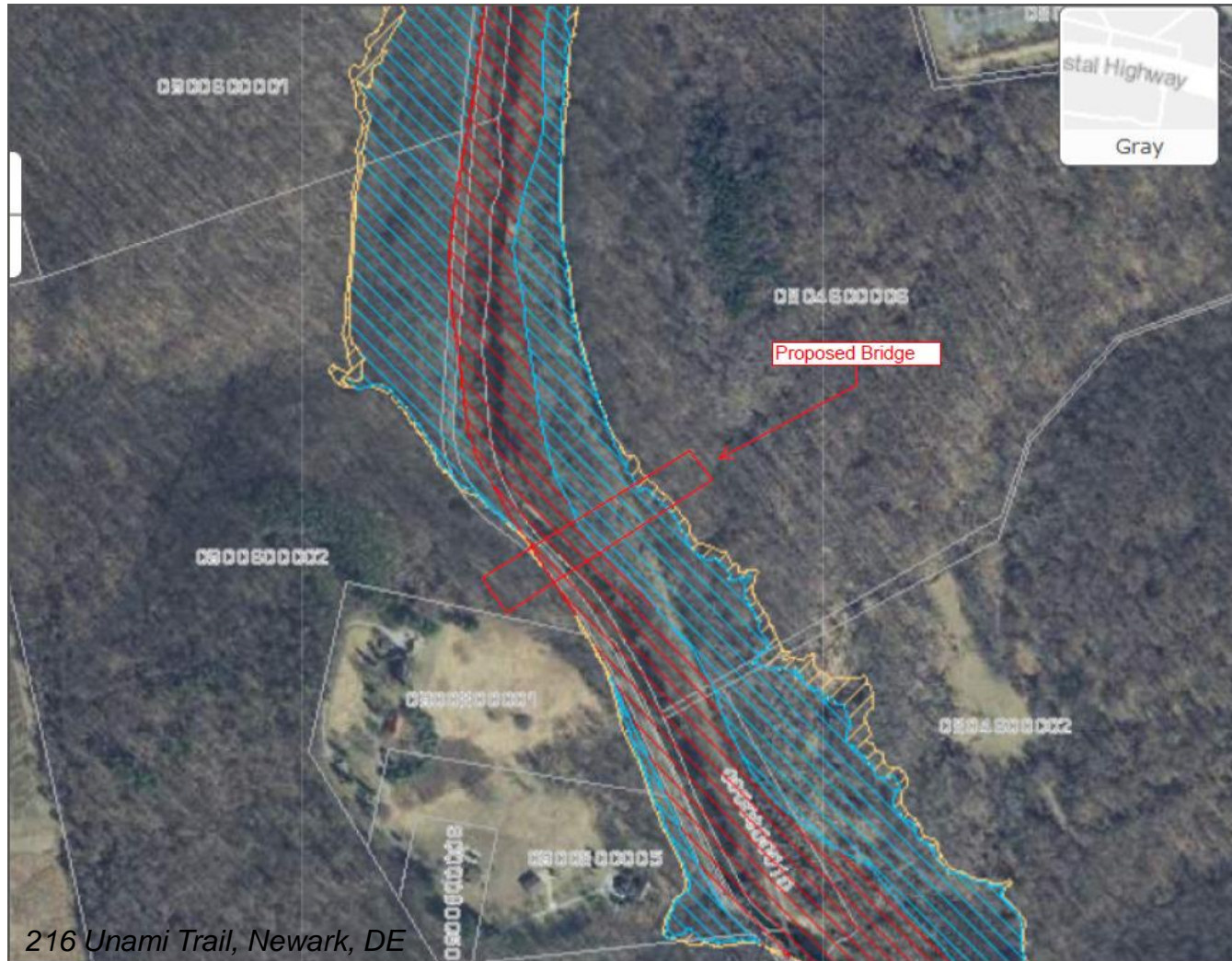
- A CLOMR is a letter from FEMA commenting on whether a project, if built as proposed, would meet minimum NFIP standards
[see 44 Code of Federal Regulations (CFR) Ch. 1, Parts 60, 65 and 72]
- A LOMR is a letter from FEMA officially revising the current Flood Insurance Rate Map (FIRM) to show changes to floodplains, floodways or flood elevations
 - Typically revises a small portion of an effective FIRM
 - 3 full size panels and few smaller panels (8.5x11 or 11x17)
 - Can also revise profiles and tables in Flood Insurance Study (FIS) report
 - Annotated maps, profiles and tables are provided with a LOMR
- A PMR is an actual Physical Map Revision whereby map panels are physically revised and republished.



When is a CLOMR Required?

- **If encroaching on a FEMA Floodway (Zone AE) and increasing WSELs by greater than 0.00 feet**
 - New bridges and culverts
 - Stream restoration/channel relocation projects
 - Proposed fill within the floodway
- **If proposing development within a limited detailed (AE) and increasing WSELs by over 1.00 foot**
- **If “no-rise” can be demonstrated as a result of the project, FEMA does not require a CLOMR**
- **No CLOMR requirements in Approximate Zone A Floodplains**
- **Communities can request that CLOMRs be submitted based on local floodplain ordinances**
- **As members of the NFIP, communities are required to meet the minimum NFIP criteria**

Proposed Floodway Encroachment



Proposed Floodplain Fringe Development





When is a LOMR Required?

§65.3 Requirement to submit new technical data.

A community's base flood elevations may increase or decrease resulting from physical changes affecting flooding conditions. As soon as practicable, but not later than six months after the date such information becomes available, a community shall notify the Administrator of the changes by submitting technical or scientific data in accordance with this part. Such a submission is necessary so that upon confirmation of those physical changes affecting flooding conditions, risk premium rates and flood plain management requirements will be based upon current data.

- **This requirement is not always followed**
- **What is considered a significant increase or decrease**
- **Advances in digital data will hopefully facilitate data sharing and collaboration**
- **Ultimate goal is to evolve to real-time mapping or “living” floodplains**



DE LOMCs

- **Very few LOMCs processed in DE over the past 5 years!**

	<u>2013</u>	<u>2014</u>	<u>2015</u>	<u>2016</u>	<u>2017</u>
LOMR	0	4	4	2	1
CLOMR	1	0	1	0	0

- **Sign of good floodplain management and restrictive ordinances???? Or....**



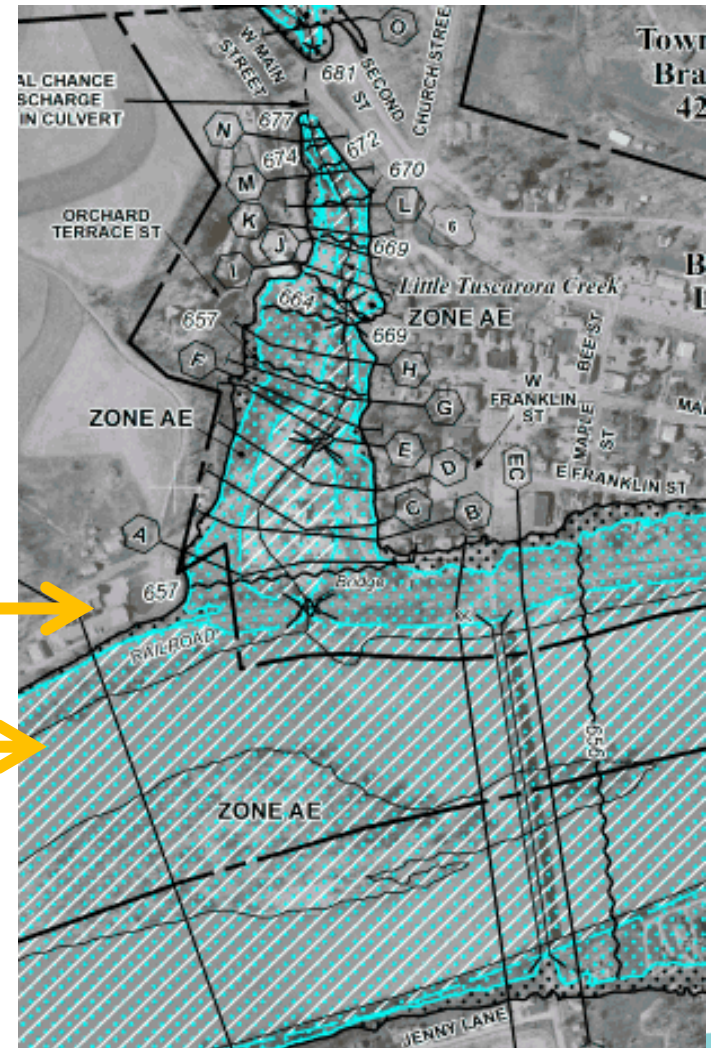
Flood Insurance Requirements

Mandatory purchase of flood insurance for structures in or touching the SFHA

Caveat – although insurance may not be required, lenders have the prerogative to require insurance to cover perceived risk

Not Required

Required





Elevation Certificate Information

U.S. DEPARTMENT OF HOMELAND SECURITY FEDERAL EMERGENCY MANAGEMENT AGENCY National Flood Insurance Program		ELEVATION CERTIFICATE IMPORTANT: Follow the instructions on pages 1-9.		OMB No. 1660-0008 Expiration Date: July 31, 2015	
SECTION A - PROPERTY INFORMATION					
A1. Building Owner's Name				FOR INSURANCE COMPANY USE	
A2. Building Street Address (including Apt., Unit, Suite, and/or Bldg. No.) or PO, Route and Box No.				Policy Number:	
City				Company NAIC Number:	
State				ZIP Code	
A3. Property Description (Lot and Block Numbers, Tax Parcel Number, Legal Description, etc.)					
A4. Building Use (e.g., Residential, Non-Residential, Addition, Accessory, etc.)					
A5. Latitude/Longitude: Lat. _____ Long. _____ Horizontal Datum: <input type="checkbox"/> NAD 1927 <input type="checkbox"/> NAD 1983					
A6. Attach at least 2 photographs of the building if the Certificate is being used to obtain flood insurance.					
A7. Building Diagram Number _____					
A8. For a building with a crawlspace or enclosure(s):					
a) Square footage of crawlspace or enclosure(s)		_____ sq ft		A9. For a building with an attached garage:	
b) Number of permanent flood openings in the crawlspace or enclosure(s) within 1.0 foot above adjacent grade		_____ sq in		a) Square footage of attached garage	
c) Total net area of flood openings in A8.b		_____ sq in		b) Number of permanent flood openings in the attached garage within 1.0 foot above adjacent grade	
d) Engineered flood openings? <input type="checkbox"/> Yes <input type="checkbox"/> No				c) Total net area of flood openings in A9.b	
				d) Engineered flood openings? <input type="checkbox"/> Yes <input type="checkbox"/> No	
SECTION B - FLOOD INSURANCE RATE MAP (FIRM) INFORMATION					
B1. NFP Community Name & Community Number		B2. County Name		B3. State	
B4. Map/Panel Number	B5. Suffix	B6. FIRM Index Date	B7. FIRM Panel Effective/Revised Date	B8. Flood Zone(s)	B9. Base Flood Elevation(s) (Zone A0, use base flood depth)
B10. Indicate the source of the Base Flood Elevation (BFE) data or base flood depth entered in item B9: <input type="checkbox"/> FIRM <input type="checkbox"/> Community Determined <input type="checkbox"/> Other/Source: _____					
B11. Indicate elevation datum used for BFE in item B9: <input type="checkbox"/> NGVD 1929 <input type="checkbox"/> NAVD 1988 <input type="checkbox"/> Other/Source: _____					
B12. Is the building located in a Coastal Barrier Resources System (CBRS) area or Otherwise Protected Area (OPA)? <input type="checkbox"/> Yes <input type="checkbox"/> No Designation Date: ____/____/____ <input type="checkbox"/> CBRS <input type="checkbox"/> OPA					
SECTION C - BUILDING ELEVATION INFORMATION (SURVEY REQUIRED)					
C1. Building elevations are based on: <input type="checkbox"/> Construction Drawings* <input type="checkbox"/> Building Under Construction* <input type="checkbox"/> Finished Construction *A new Elevation Certificate will be required when construction of the building is complete.					
C2. Elevations - Zones A1-A30, AE, AH, A (with BFE), VE, V1-V30, V (with BFE), AR, AR/A, AR/AE, AR/A1-A30, AR/AH, AR/AO. Complete items C2.a-h below according to the building diagram specified in item A7. In Puerto Rico only, enter meters. Benchmark Utilized: _____ Vertical Datum: _____ Indicate elevation datum used for the elevations in items a) through h) below. <input type="checkbox"/> NGVD 1929 <input type="checkbox"/> NAVD 1988 <input type="checkbox"/> Other/Source: _____ Datum used for building elevations must be the same as that used for the BFE.					
Check the measurement used.					
a) Top of bottom floor (including basement, crawlspace, or enclosure floor)		<input type="checkbox"/> feet <input type="checkbox"/> meters			
b) Top of the next higher floor		<input type="checkbox"/> feet <input type="checkbox"/> meters			
c) Bottom of the lowest horizontal structural member (V Zones only)		<input type="checkbox"/> feet <input type="checkbox"/> meters			
d) Attached garage (top of slab)		<input type="checkbox"/> feet <input type="checkbox"/> meters			
e) Lowest elevation of machinery or equipment servicing the building (Describe type of equipment and location in Comments)		<input type="checkbox"/> feet <input type="checkbox"/> meters			
f) Lowest adjacent (finished) grade next to building (LAG)		<input type="checkbox"/> feet <input type="checkbox"/> meters			
g) Highest adjacent (finished) grade next to building (HAG)		<input type="checkbox"/> feet <input type="checkbox"/> meters			
h) Lowest adjacent grade at lowest elevation of deck or stairs, including structural support		<input type="checkbox"/> feet <input type="checkbox"/> meters			
SECTION D - SURVEYOR, ENGINEER, OR ARCHITECT CERTIFICATION					
This certification is to be signed and sealed by a land surveyor, engineer, or architect authorized by law to certify elevation information. I certify that the information on this Certificate represents my best efforts to interpret the data available. I understand that any false statement may be punishable by fine or imprisonment under 18 U.S.C. Section 1001.					
<input type="checkbox"/> Check here if comments are provided on back of form. <input type="checkbox"/> Were latitude and longitude in Section A provided by a licensed land surveyor? <input type="checkbox"/> Yes <input type="checkbox"/> No					
Certifier's Name		License Number		PLACE SEAL HERE	
Title		Company Name			
Address		City			
State		ZIP Code			
Signature		Date			
Telephone					

FEMA Form 086-0-33 (Revised 7/12)

See reverse side for continuation.

Replaces all previous editions.

State of Delaware
The Official Website of the First State

Home

Search

Legend

Results

Effective Flood Zone:
X
Preliminary Flood Zone:
A
FEMA Issued Flood Map:
10003C0145J
Effective Map Date:
1/16/2007
Watershed (HUC12):
Army Creek-Delaware River
Preliminary Advisory Flood
Height: 35.2
Download Model:

Print

Contacts

Getting Started/Help

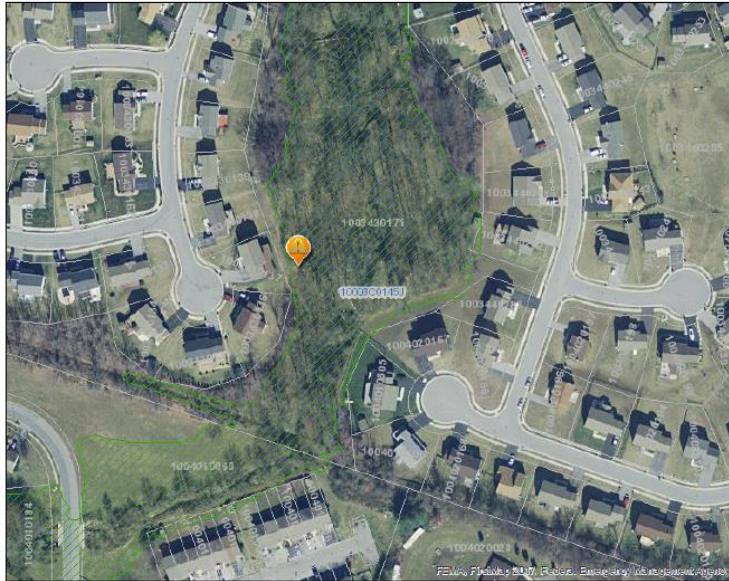
Privacy | Contact | Phone Directory

Elevation Certificate Information



Delaware Flood Planning Tool

Location is **ADDED** to
the FEMA 100-year
floodplain in the Preliminary Map



Location of flood information

Effective Flood Hazard Areas

- A
- AE
- AE, FLOODWAY
- AO
- VE
- X, 0.2 PCT ANNUAL CHANCE FLOOD HAZARD
- Base Flood Elevation
- LIMWA
- Cross Sections
- Transect

Preliminary Flood Hazard

- A
- AE
- AE, FLOODWAY
- X, 0.2 PCT ANNUAL CHANCE FLOOD HAZARD

- Contours
- INDEX
- DEPRESSION
- HIDDEN
- INTERVAL

Effective Flood Zone: X
Preliminary Flood Zone: A
FEMA Issued Flood Map: 10003C0145J
Effective Date: 1/16/2007
Watershed (HUC12):
Army Creek-Delaware River
Preliminary Advisory Flood Height: 35.2

March 11, 2018



Effective Flood Zone: X
Preliminary Flood Zone: A
FEMA Issued Flood Map: 10003C0145J
Effective Date: 1/16/2007
Watershed (HUC12):
Army Creek-Delaware River
Preliminary Advisory Flood Height: 35.2



DNREC Flood Tool and eLOMAs

- **Should be accepted for DE approximate areas!**
- **eLOMAs = Instant printable determination. If audited and passes audit takes about 5 business days. If audit fails it goes into regular LOMA process.**
- **Online LOMC Tool – 30-60 days but saves in mailing times. May save up to 15 business days vs paper submission.**
- **Paper MT-EZ and MT-1 submissions – 30-60 days**
- *****These times imply all necessary data is supplied to complete the application.**



eLOMAs

National eLOMAs –

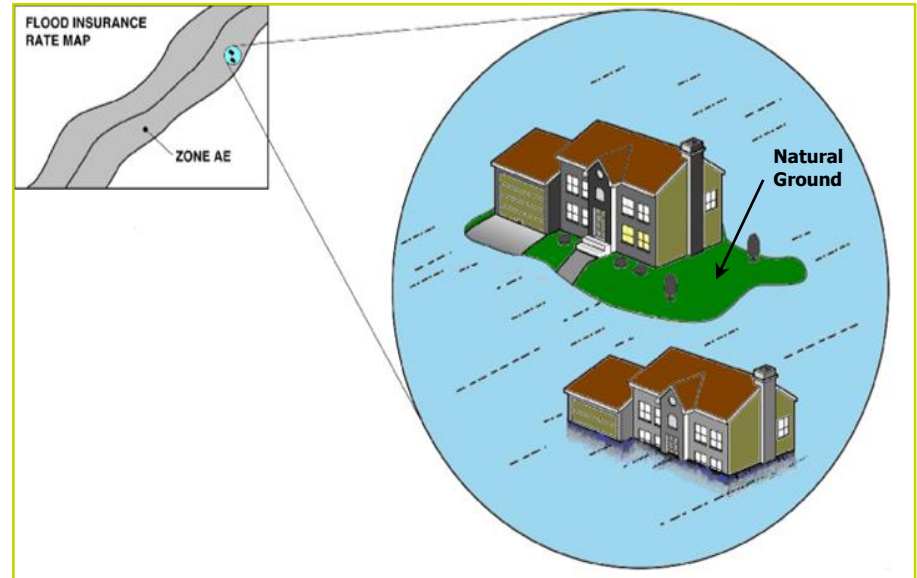
- Since eLOMA Launch (2006) – 41,178
- Last 12 months through 9/30/2015 – 5,535

Region 3 eLOMAs –

- Since eLOMA Launch (2006) – 2,552
- Last 12 months through 9/30/2015 – 314

DE eLOMAs –

- Since eLOMA Launch (2006) – 109
- Last 12 months through 9/30/2015 – 15

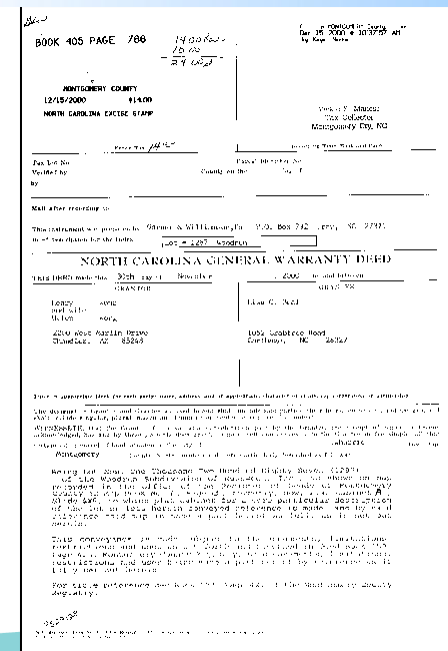


With the use of interactive websites such as the DNREC Flood tool and the increased functionality of the eLOMA tool itself (enhancements launched early 2015) the # of eLOMAs is expected to steadily increase every year as the current trend has been since 2006.

Saving time and money for the NFIP and property owners!



- Legal property description
- Requester information
- Community information (CID number, etc...)
- Map panel information
- Latitude and longitude coordinates
- Elevation information (LAG)
- BFE (calculated using FIS text/profile in AE, **DNREC Tool**, or generated BFE)





eLOMA Criteria

What kind of LOMAs can LPs and CPs submit?

- eLOMA accepts all **LOMA** requests that are **not**:
 - Considered within a coastal zone (Flood Zone V) or an alluvial fan
 - Modified by fill to raise the elevation of the structure
 - Currently being processed by another LOMA application by FEMA
- Additionally, eLOMA does **not** accept:
 - Conditional Letters of Map Amendment (**CLOMA**)
 - Conditional Letters of Map Revision Based on Fill (**CLOMR-F**)
 - Letters of Map Revision (**LOMR**)
 - Letters of Map Revision Based on Fill (**LOMR-F**) requests



Delaware MT-1 Statistics

DE Completions March 2017 through February 2018					
Month	CLOMR-F	LOMR-F	CLOMA	LOMA	Monthly Total
March		5		14	19
April				2	2
May		1		7	8
June	1	3		9	13
July	2	2		10	14
August	4	3		6	13
September	1			7	8
October				9	9
November	1	1		3	5
December		1		5	6
January		3		3	6
February		3		1	4
Total	9	22		76	107



Leveraging FEMA/DNREC Data

- **More “timely” and comprehensive access to FEMA modeling data**
- **Utilize models as a baseline for update**
 - Enhance with more detailed cross-section and structure information
- **Can typically be used as existing conditions models for FEMA evaluations, or easily updated**
- **What-if scenario modeling**
- **Ultimate goal to provide updated models back to DNREC**
- **Collaborative environment - moving towards “living floodplains”**
- **Help to identify areas for future update**



Model Downloads

Home

Search

Legend

Results

No

Effective Base Flood Elevation:
See profile in FIS Report to determine BFE

Preliminary Base Flood Elevation:
n/a

Download Model:

Appo_River.zip
Deep_Creek.zip

Print

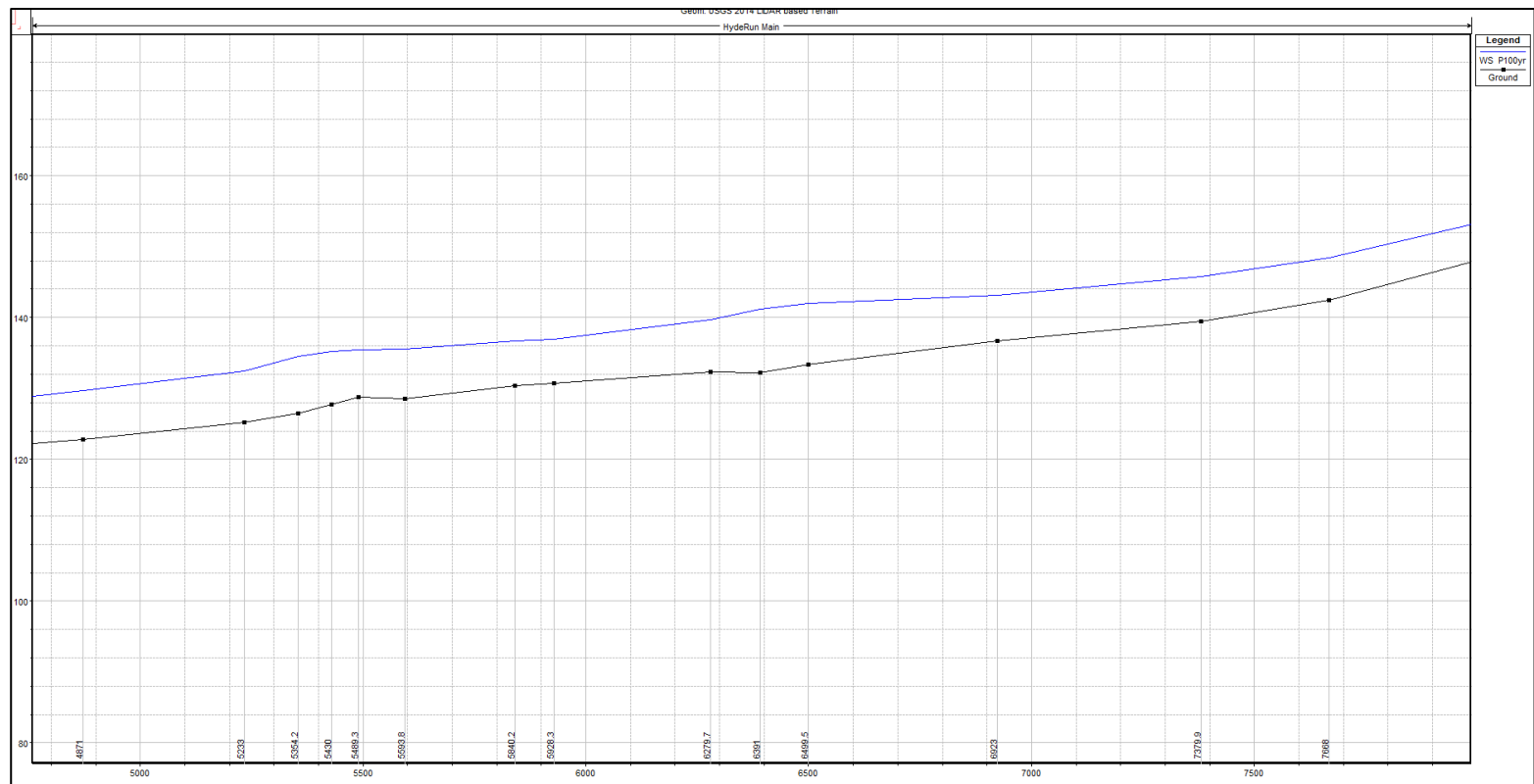
Contacts

Getting Started/Help

The map displays a residential area with property boundaries and flood zones. A blue hatched area represents the flood zone, with various elevation markers such as 59 Feet, 61 Feet, 62 Feet, 65 Feet, 67 Feet, 69 Feet, 70 Feet, and 74 Feet. Purple lines labeled BE, BF, BG, and BH indicate different flood zones. A yellow warning icon is placed on a road labeled "Dr. ... Rd". A green dot with the number "10003" is also visible. The map includes a "Satellite" inset in the top right corner and a "FEMA | FirstMap 2016 | Federal Emergency..." footer.



Profile Plot – Without Structure

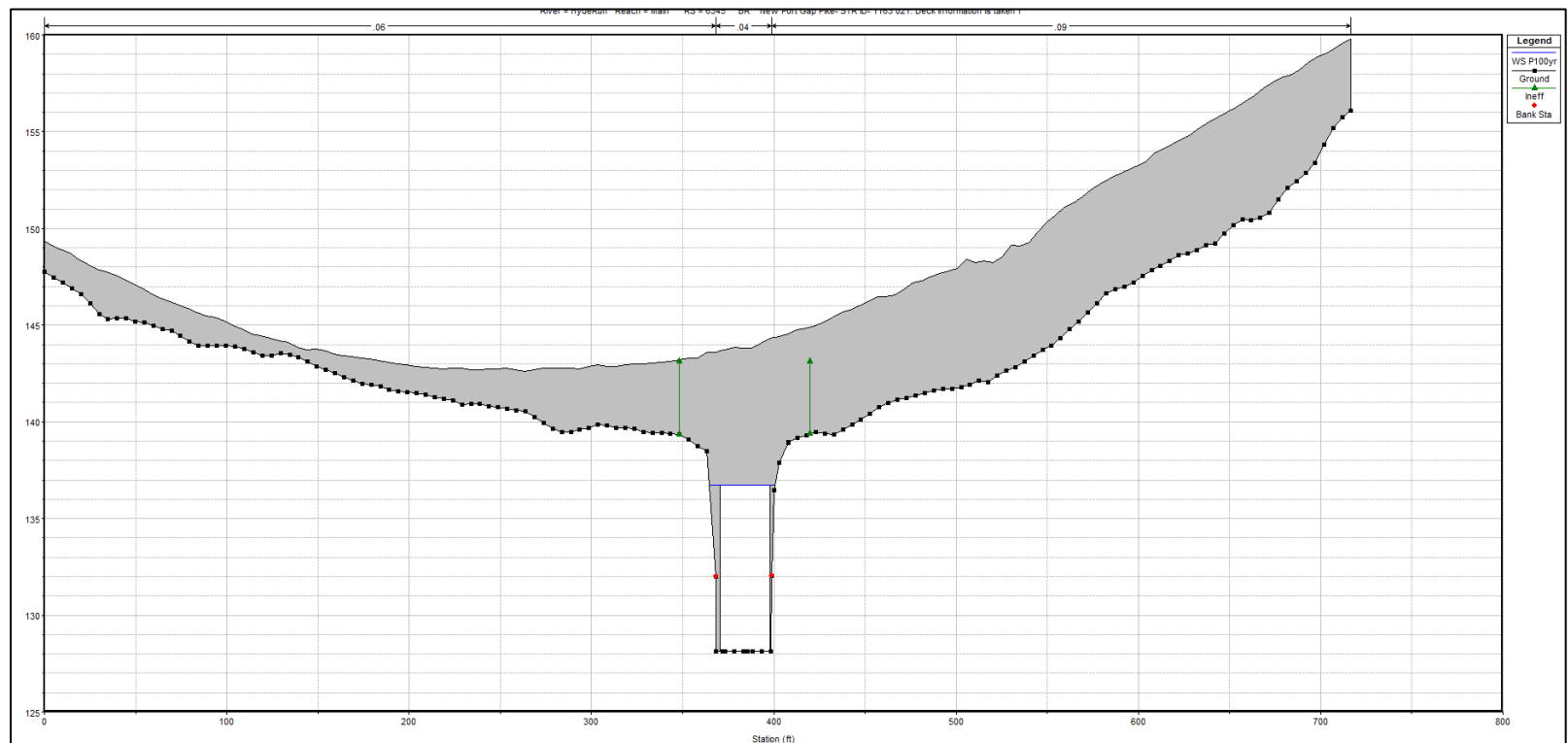




Hyde Run – Updated Culvert

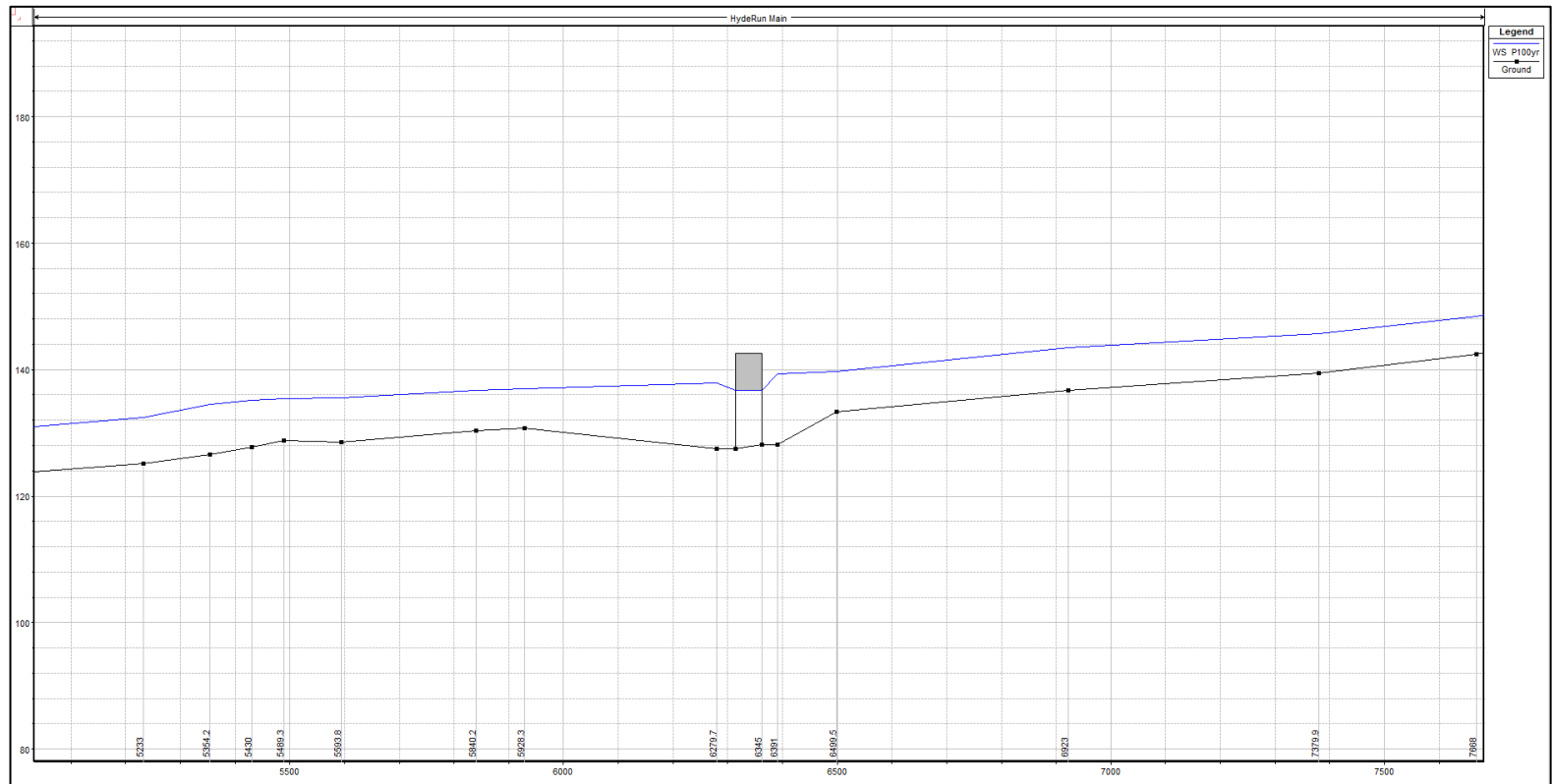
Cross-Section Geometry – **With** Structure

Internal XS: Upstream deck and structure opening





Profile Plot – With Structure

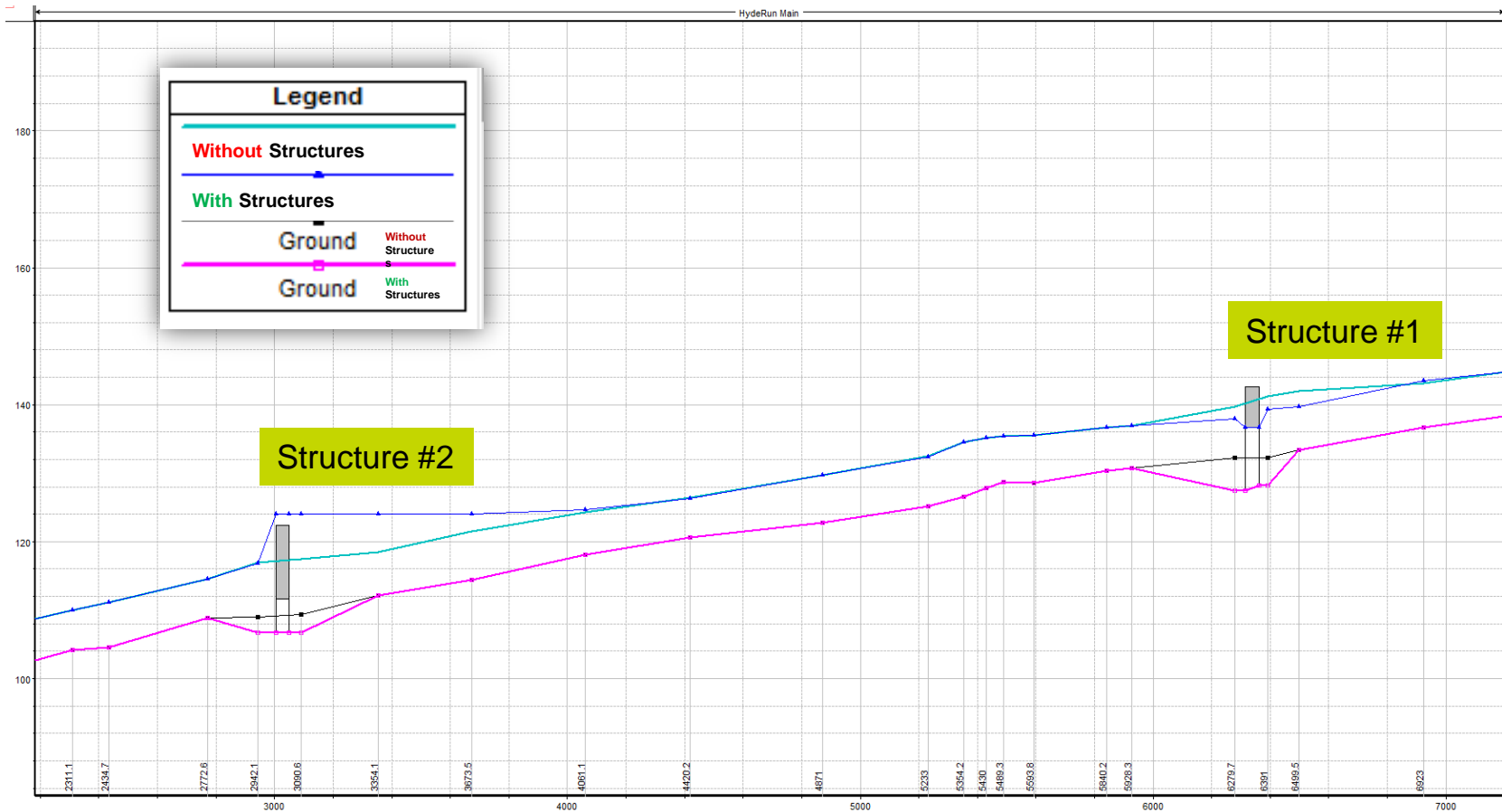


Hyde Run Comparison





Comparison Profile Plots



Review/Quiz/Discussion

DNREC Floodplain Management Training Review/Quiz

Question 1: DNREC is located at 89 Kings Highway, Dover, DE. They are proposing construction of an additional office building towards the rear of their property that would be located within the FEMA designated floodplain. This proposed structure will require the placement of fill.



1. What is the effective FEMA floodplain Zone designation at the location of the proposed structure?
2. What is the estimated 1% annual chance (100-year) water-surface elevation at this location using the DNREC website?
3. How would a more accurate FEMA regulatory water-surface elevation be determined?
4. Under FEMA's minimum NFIP regulations, is DNREC required to perform an updated hydraulic analysis to evaluate impacts to 1% annual chance water-surface elevations?
5. Is a FEMA Conditional Letter of Map Revision (CLOMR) required?
6. Assuming the community has a more restrictive 2-foot freeboard requirement, what would be the estimated minimum elevation requirement for the lowest floor?
7. If elevated above the FEMA Base Flood Elevation (BFE) based on the placement of fill, would this structure be eligible for a Letter of Map Amendment (LOMA)?

Question 2: A new residential home is proposed at 3200 Heritage Dr., Wilmington, DE at the location identified below.



1. What is the status of the 1% annual chance floodplain for Hyde Run (Preliminary or Effective)?
2. Is the proposed structure footprint located within the designated 1% annual chance floodplain?
3. What is the EFFECTIVE floodplain Zone designation for the site?
4. If applicable, what is the PRELIMINARY floodplain Zone designation for the site?
5. Does FEMA require that a floodplain study be performed to support this development?
6. What is the advisory flood height at this location?
7. What would be the estimated elevation requirement for the lowest floor?
8. If this residential structure is built, will there likely be an NFIP flood insurance purchase requirement?
9. Is the hydraulic model able to be downloaded for this flooding source?

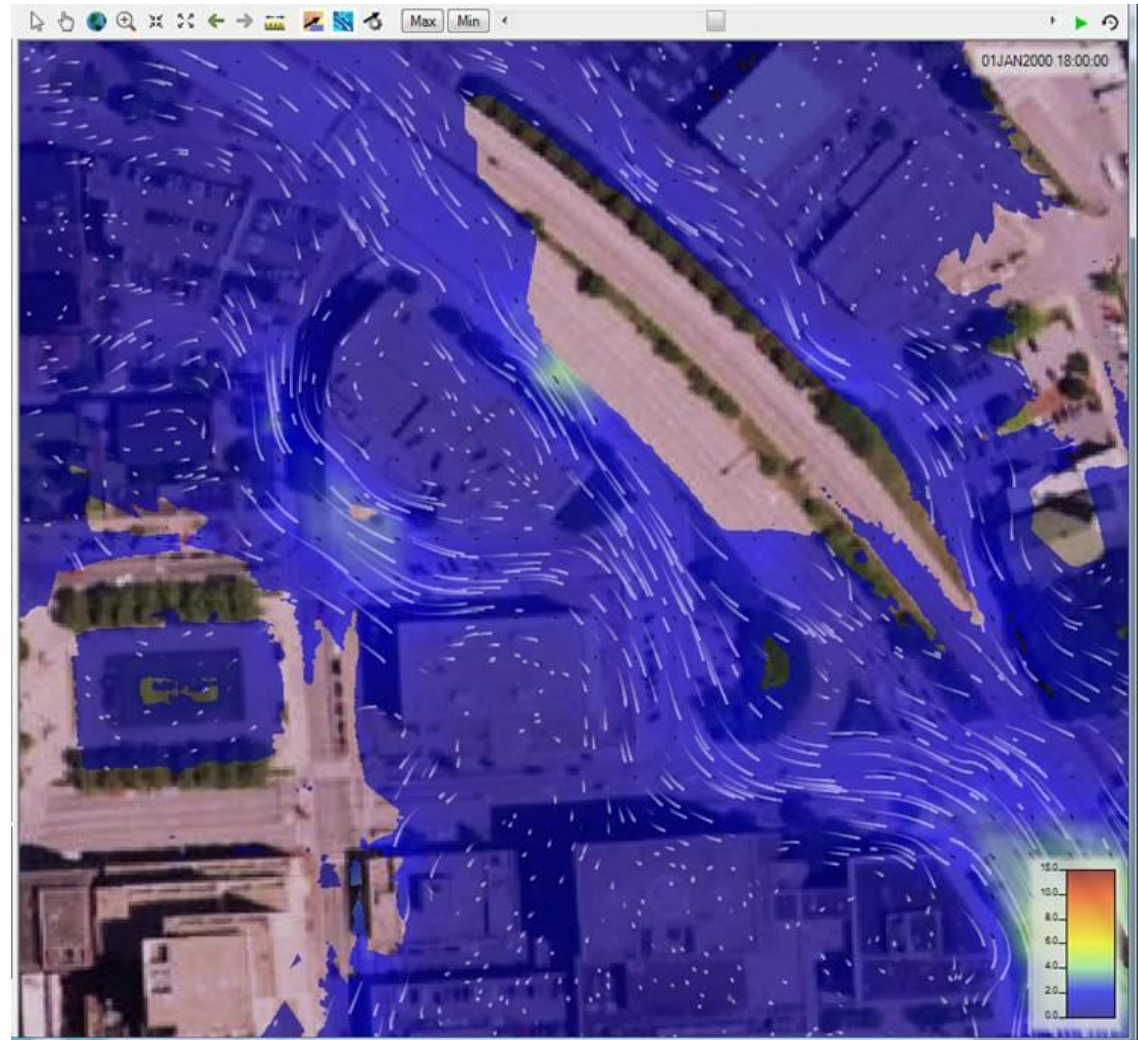
Problem 3: A stream restoration project is proposed for the reach of the Christina River identified below, southeast of the S. College Avenue exit off of I-95 in New Castle County, DE.



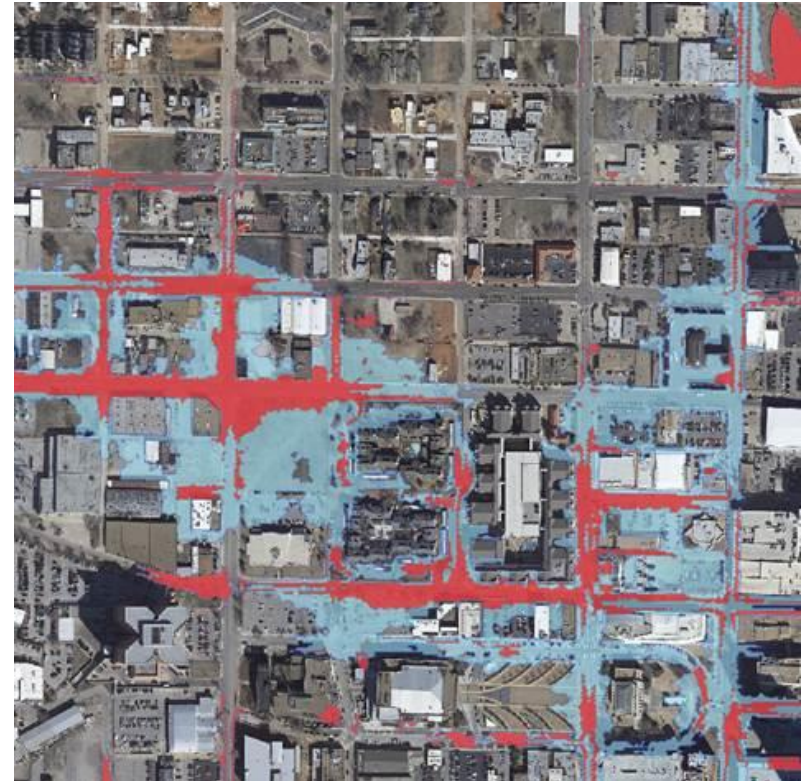
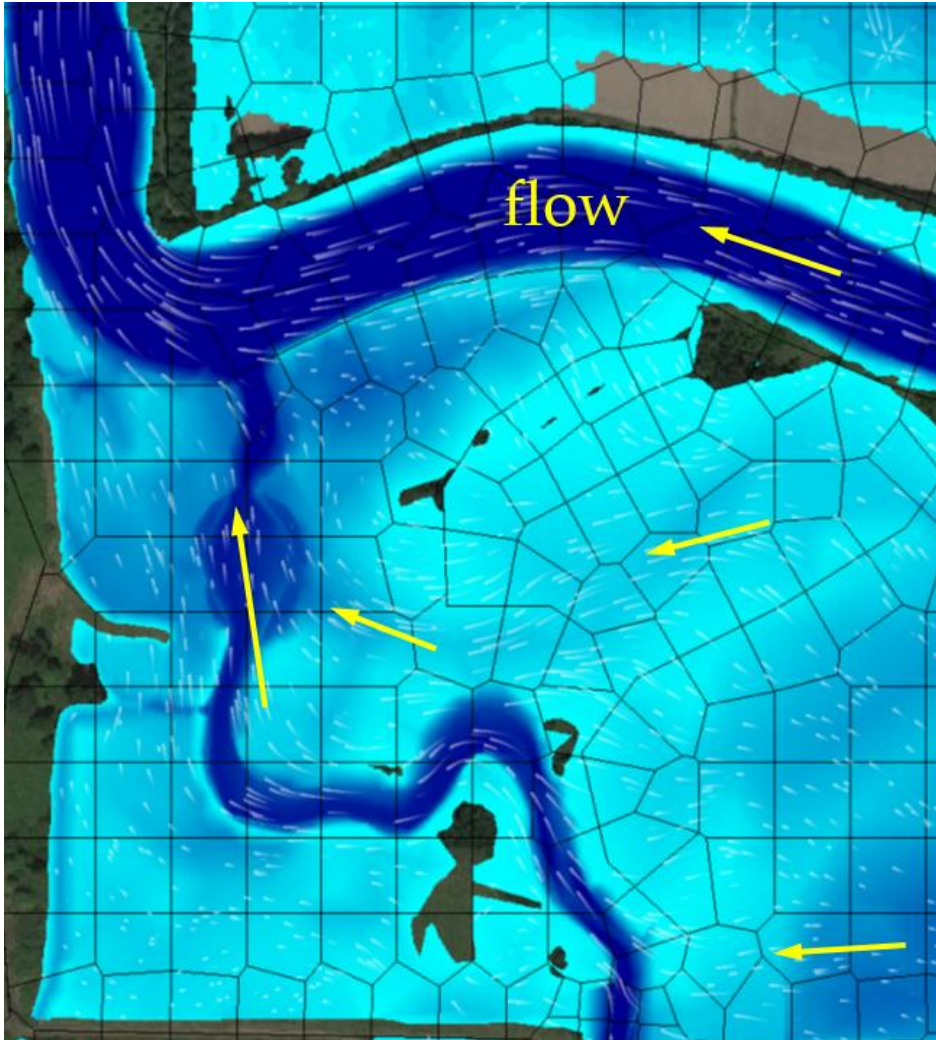
1. What FEMA EFFECTIVE flood zone is impacted by the proposed project?
2. Is an updated floodplain study evaluating the impacts to 1% annual chance water-surface elevations required based on FEMA minimum NFIP requirements?
3. If the project results in increases to the 1% annual chance water-surface elevations, is a FEMA CLOMR required?
4. If "no-rise" in 1% annual chance water-surface elevations can be demonstrated as a result of the project, is a FEMA CLOMR required?
5. After project completion, should the updated floodplain study information be submitted New Castle County and FEMA?

What's Next with Hydraulic Modeling???

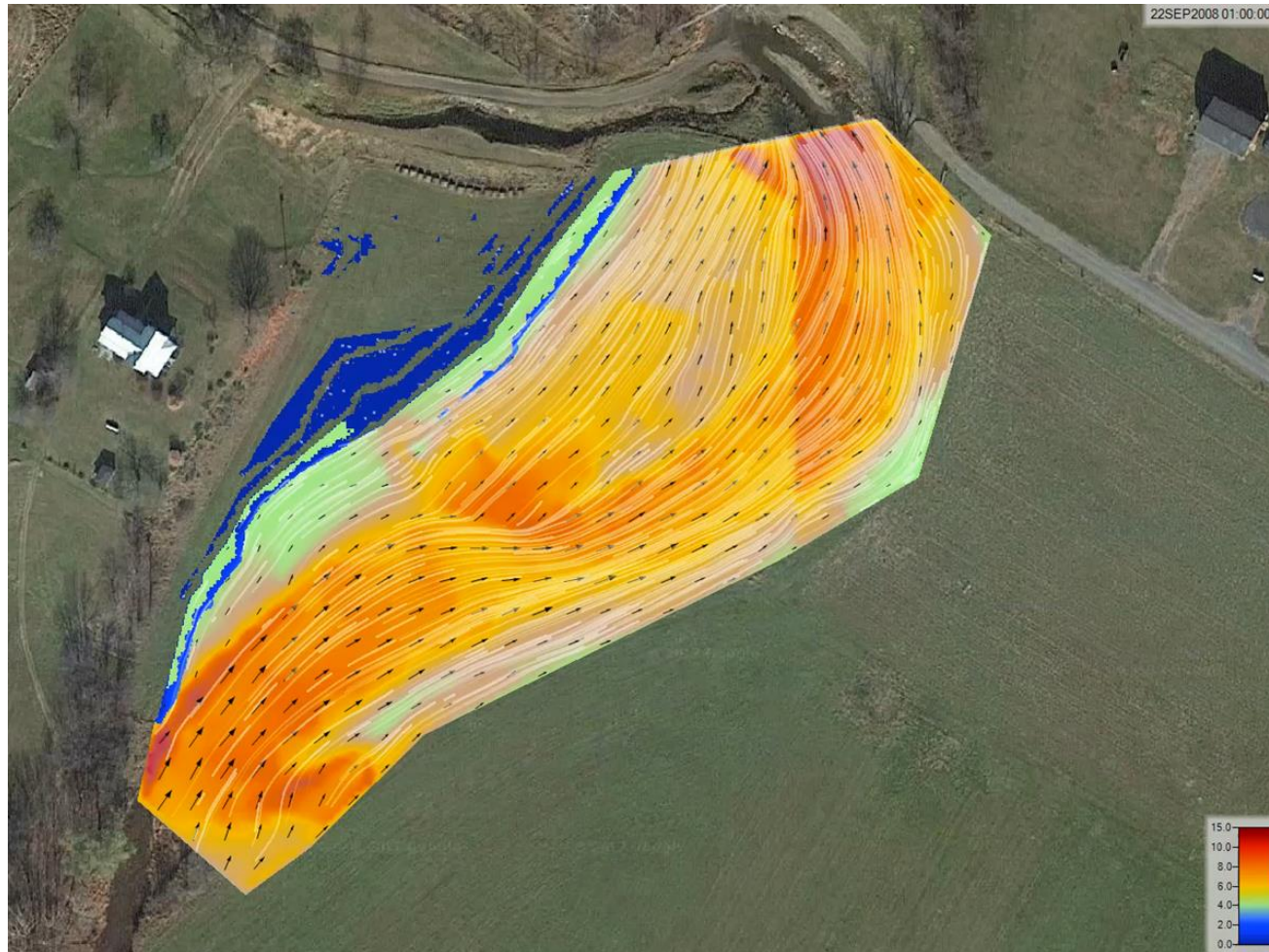
- Moving towards 2D!
- HEC-RAS 5.0
- SRH-2D



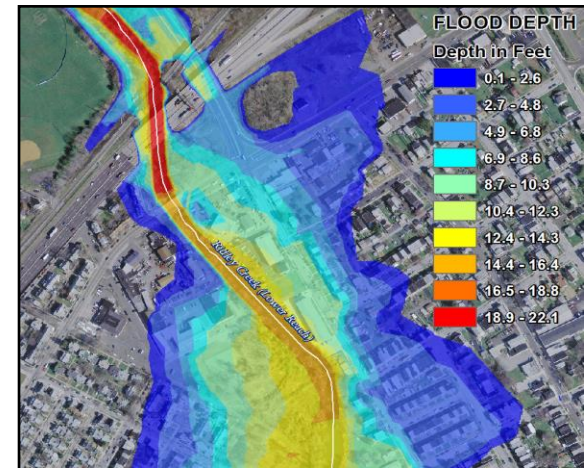
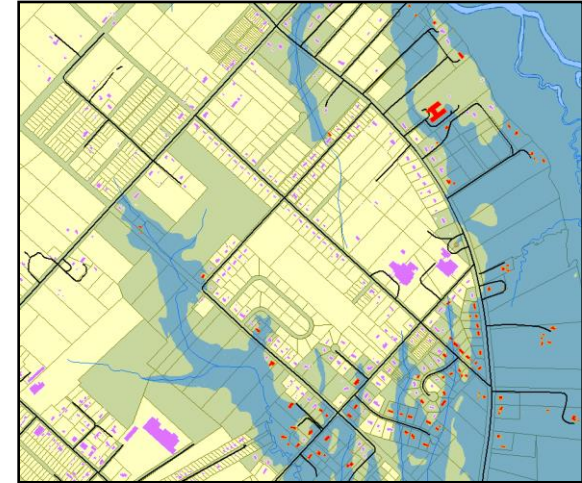
Two Dimensional Floodplain Modeling



Two Dimensional Floodplain Modeling



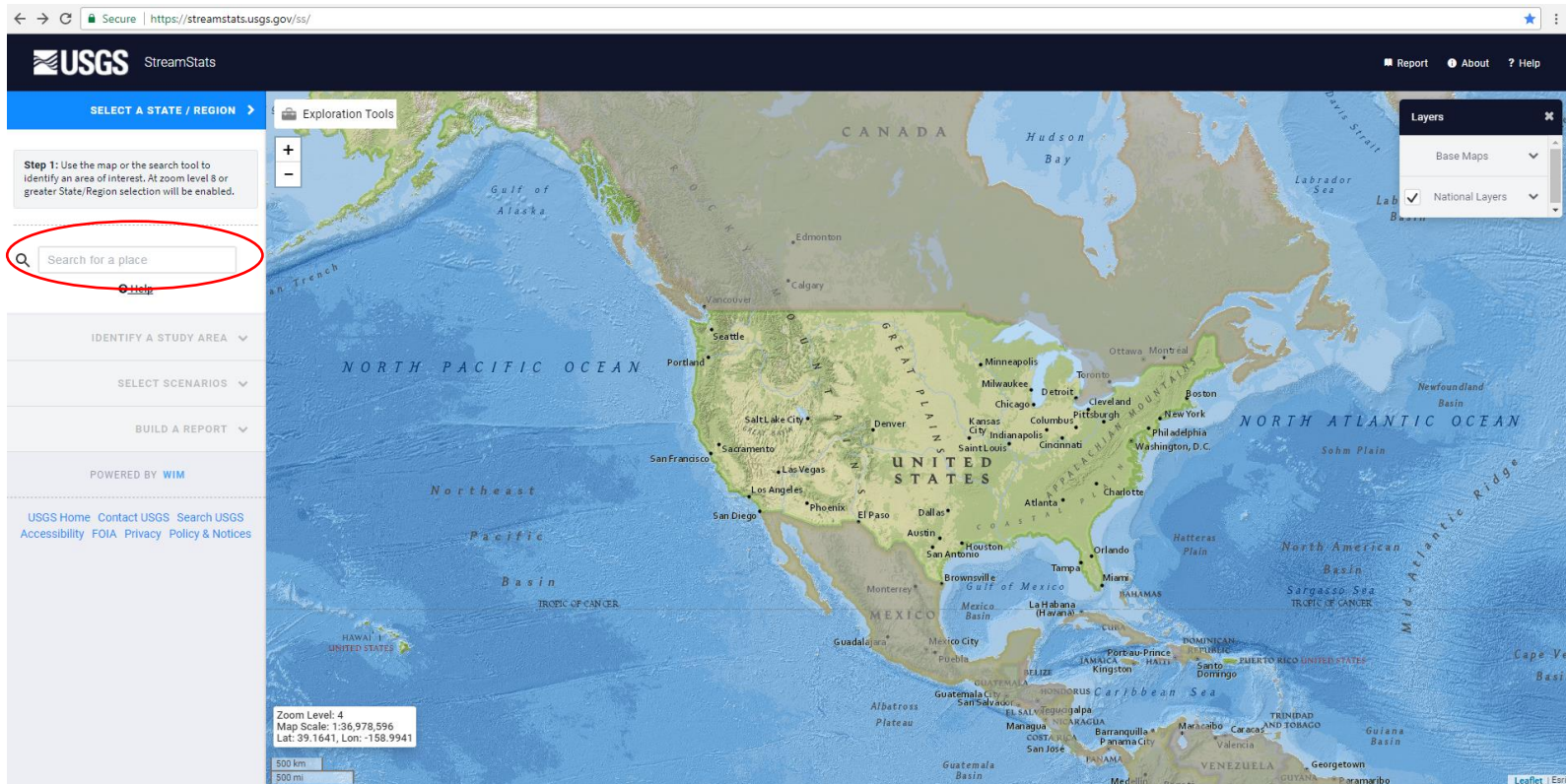
Questions?



<http://maps.dnrec.delaware.gov/FloodPlanning/default.html>

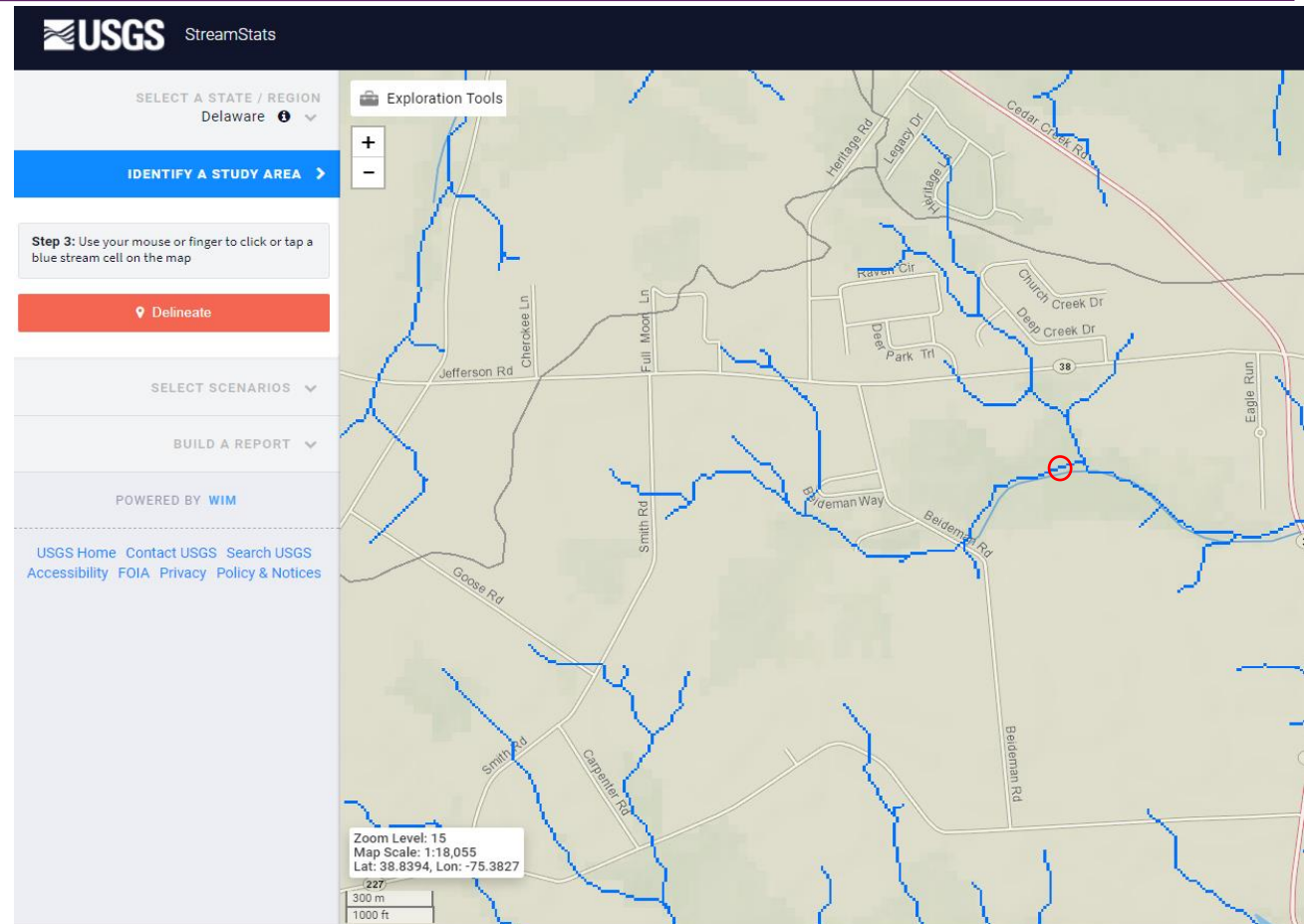


StreamStats: <https://streamstats.usgs.gov/ss/>





Zoom in to view the NHD flow network, press the Delineate button, and select the desired discharge location along the NHD Flowline.

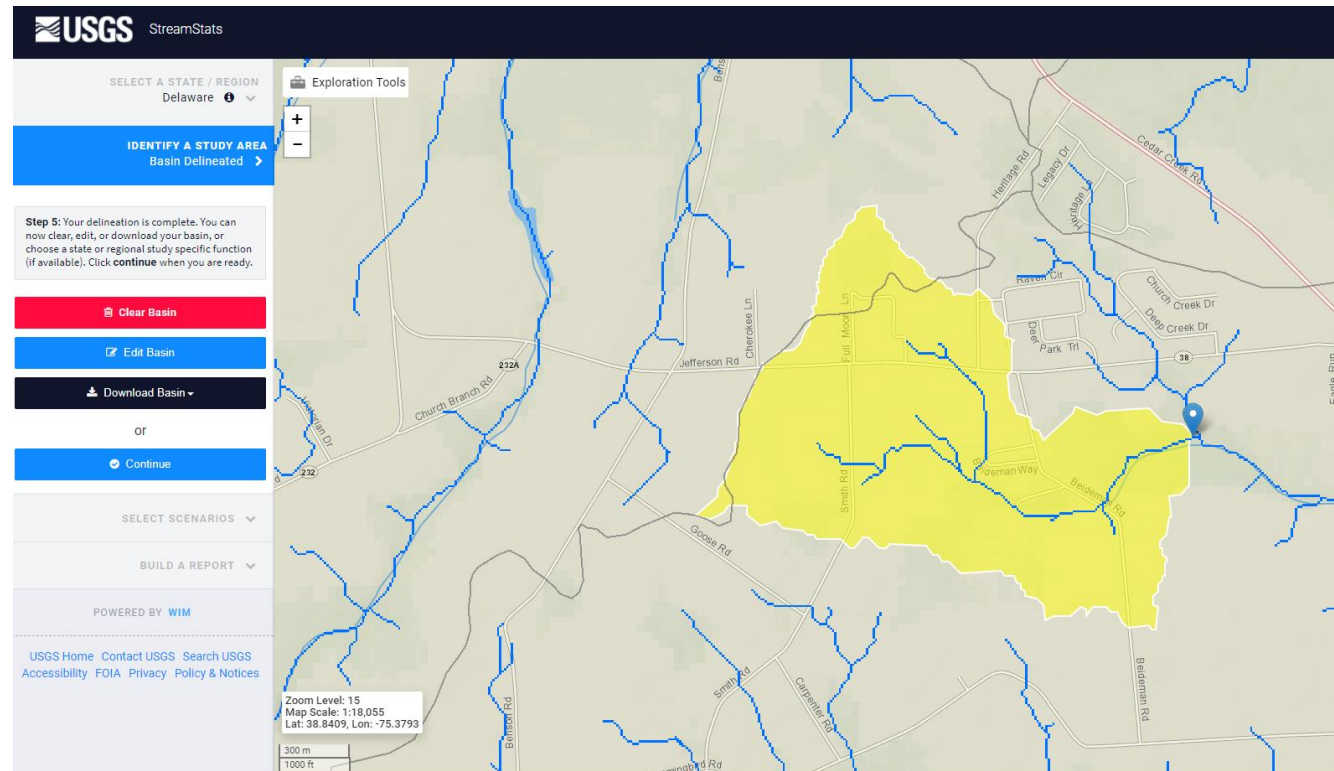




StreamStats will delineate the drainage area and highlight it in yellow.

From here you can download a GeoJSON, Shapefile or ESRI File GDB of the basin (Download Basin).

To move on to computing the discharges you must click “Continue.”





IDENTIFY A STUDY AREA
Basin Delineated ▾

SELECT SCENARIOS ➤

Step 1: Select a scenario below, or expand the "Basin Characteristics" panel to select specific basin characteristics.

Regression Based Scenarios ⓘ

Peak-Flow Statistics

Basin Characteristics ▾



A scenario OR one or more basin characteristics from the dropdown above must be selected to continue

Continue

BUILD A REPORT ▾

POWERED BY WIM

Select available reports to display:

☒ Basin Characteristics Report

☒ Scenario Flow Reports

Continue

Select "Peak-Flow Statistics" and then "Continue" to generate a report of the discharge results and default basin characteristics.

Basin Characteristics ▴

Select All Basin Characteristics

Select	Parameter	Description
<input checked="" type="checkbox"/>	BSLDEM10M	Mean basin slope computed from 10 m DEM
<input checked="" type="checkbox"/>	DRNAREA	Area that drains to a point on a stream
<input type="checkbox"/>	FOREST	Percentage of area covered by forest
<input type="checkbox"/>	IMPNLCD01	Percentage of impervious area determined from NLCD 2001 impervious dataset
<input type="checkbox"/>	LC11DEV	Percentage of developed (urban) land from NLCD 2011 classes 21-24
<input type="checkbox"/>	LC11IMP	Average percentage of impervious area determined from NLCD 2011 impervious dataset
<input checked="" type="checkbox"/>	SOILA	Percentage of area of Hydrologic Soil

You can add additional basin characteristics to the report by selecting the down arrow and checking the boxes next to the desired characteristics.



Basin Characteristics

Parameter Code	Parameter Description	Value	Unit
DRNAREA	Area that drains to a point on a stream	0.78	square miles
BSLDEM10M	Mean basin slope computed from 10 m DEM	0.59	percent
SOILA	Percentage of area of Hydrologic Soil Type A	60	percent

Here it shows all selected basin characteristics.

Peak-Flow Statistics Parameter 3 [Coastal Plain Region]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	0.78	square miles	0.51	117
BSLDEM10M	Mean Basin Slope from 10m DEM	0.59	percent	0.3	3.69
SOILA	Percent Hydrologic Soil Type A	60	percent	0.53	60

Here it shows the basin characteristics that are used to calculate discharge and the min and max limits of these parameters for use in the regression equation.

Peak-Flow Statistics Flow Report 4 [Coastal Plain Region]

PII: Prediction Interval-Lower, PIu: Prediction Interval-Upper, SEp: Standard Error of Prediction, SE: Standard Error (other -- see report)

Statistic	Value	Unit	PII	PIu	SE	SEp	Equiv. Yrs.
2 Year Peak Flood	19.2	ft ³ /s	6.58	56.2	67.4	67.4	0.8
5 Year Peak Flood	31.5	ft ³ /s	11.9	83.9	60.1	60.1	1.6
10 Year Peak Flood	41.2	ft ³ /s	15.8	108	58.5	58.5	2.4
25 Year Peak Flood	54.8	ft ³ /s	15.9	189	59	59	3.5
50 Year Peak Flood	65.7	ft ³ /s	18.2	237	60.8	60.8	4.2
100 Year Peak Flood	77.5	ft ³ /s	20.2	296	63.4	63.4	4.8
200 Year Peak Flood	89.8	ft ³ /s	21.9	368	66.9	66.9	5.2
500 Year Peak Flood	107	ft ³ /s	23.6	485	72.3	72.3	5.6

At the bottom are the final results and a citation to the regression equations source.

This report can be downloaded as a .CSV or printed to a pdf.

Peak-Flow Statistics Citations

[Ries, K.G., III, and Dillow, J.J.A., 2006, Magnitude and frequency of floods in Delaware: Scientific Investigations Report 2006-5146, 59 p.](#)



To see what data StreamStats uses to determine basin characteristics click the info button and follow the provided links for that specific area.

The screenshot shows the USGS StreamStats web application. On the left is a sidebar with navigation options: "SELECT A STATE / REGION" (with "Delaware" selected and an info icon circled in red), "Start Over", "Step 1: Use the map or the search tool to identify an area of interest...", "Search for a place", "Help", "IDENTIFY A STUDY AREA" (with "Basin Delineated" selected), "SELECT SCENARIOS", "BUILD A REPORT" (with "Report Built" selected), and "POWERED BY WIM". The main area shows a map of Delaware. An "About StreamStats v4.2.0" popup is open, displaying information about the application. The popup has tabs for "About the project", "State / Regional Info", "News", and "Disclaimers". The "State / Regional Info" tab is active, showing "StreamStats in Delaware". It includes a paragraph about the report, a citation for "Ries, K.G., III, and Dillow, J.J.A., 2006, Magnitude and frequency of floods in Delaware: Scientific Investigations Report 2006-5146, 46 p.", and a link "Click on this link" to obtain general information, which is circled in red. The popup also mentions cooperation with the "Delaware Geological Survey" and the "Delaware Department of Transportation". Logos for the "RESEARCH DELAWARE GEOLOGICAL SURVEY" and the "STATE OF DELAWARE Department of Transportation" are shown at the bottom of the popup. A "Close" button is in the bottom right corner of the popup. The background map shows a zoom level of 1, a map scale of 1:100,000, and coordinates of Lat: 38.8348, Lon: -75.4405.



StreamStats results can easily be verified with a quick hand calculation.

Coastal Plain region

$$PK2 = 92.8DRNAREA^{0.710}BSLDEM10M^{0.303}(SOILA+1)^{-0.301} \quad (10)$$

$$PK5 = 157DRNAREA^{0.710}BSLDEM10M^{0.292}(SOILA+1)^{-0.310} \quad (11)$$

$$PK10 = 210DRNAREA^{0.709}BSLDEM10M^{0.289}(SOILA+1)^{-0.316} \quad (12)$$

$$PK25 = 288DRNAREA^{0.711}BSLDEM10M^{0.292}(SOILA+1)^{-0.323} \quad (13)$$

$$PK50 = 353DRNAREA^{0.712}BSLDEM10M^{0.297}(SOILA+1)^{-0.328} \quad (14)$$

$$PK100 = 425DRNAREA^{0.715}BSLDEM10M^{0.303}(SOILA+1)^{-0.332} \quad (15)$$

$$PK200 = 505DRNAREA^{0.717}BSLDEM10M^{0.310}(SOILA+1)^{-0.337} \quad (16)$$

$$PK500 = 623DRNAREA^{0.720}BSLDEM10M^{0.320}(SOILA+1)^{-0.344} \quad (17)$$

Parameter Name	Value	Units
Drainage Area	0.78	square miles
Mean Basin Slope from 10m DEM	0.59	percent
Percent Hydrologic Soil Type A	60	percent

$$PK100 = 425 * 0.78^{0.715} * 0.59^{0.303} * (60+1)^{-0.332} = 77.5$$

This is equal to the StreamStats result:

100 Year Peak Flood	77.5	ft ³ /s
---------------------	------	--------------------